Updated Geotechnical Investigation and Slope Stability Analysis. Proposed Residential Development
37 Wildpine Court
Ottawa, Ontario

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Executive Summary

EXP Services Inc. (EXP) is pleased to present the updated geotechnical investigation and slope stability analysis for the proposed residential development at the property registered by the street address of 37 Wildpine Court, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: P90800GM dated October 21, 2020. It was authorized by Wildpine Trails Inc. (the client) on November 11, 2020. The update is required due to change in the type of the proposed structures at the site, i.e. from residential townhouses blocks to a four (4) storey, 94 unit apartment building with one level of underground parking and a one semi detached residential building.

The proposed new development as per Site Plan prepared by PMA Architects under their project 21010 dated June 13, 2023 would comprise of a four (4) storey, 94 unit apartment building with one level of underground parking and one semi detached residential building. . The underside of footing and basement of the proposed apartment building will be set at Elevation 114.8 to 115.5 m and 116.25 m respectively . The underside of footing of the semi-detached building will be set at Elevation 117.0 m. The finished floor of both buildings will be set at Elevation 120.0 m. Underground services, access road and surface parking facility will also be constructed as part of the proposed development.

The site is currently occupied by a residential dwelling, garage, and metal shed which will be demolished/decommissioned to permit the construction of the proposed development. Part of Poole Creek and wetlands are present on the east property line and extends through the site to the northwest side of the development.

The fieldwork for the geotechnical investigation was completed on December 11 and 18, 2020 and May 5, 2021 and consists of eighteen (18) testholes (Borehole Nos. 2 to 4, Borehole Nos. 6 to 8, and Test Pit Nos. 1 to 7, 1A, 2A, 4A, 4B, and 4C) advanced to depths ranging between 1.1 m and 6.4 m below the existing ground surface.

The geotechnical investigation revealed the subsurface conditions at the site to generally comprise of silty sand with gravel fill extending to depths ranging from 0.9 m to 3.0 m (Elevation 113.3 m to Elevation 116.7 m), underlain by organic silty sand to sandy silt (peat-like) to depths ranging from 1.9 m to 4.1 m (Elevation 112.3 m to Elevation 114.8 m). The organic soils are underlain by sandy silt to depths of 5.1 m and 5.8 m (Elevation 110.6 m and Elevation 110.3 m), and by glacial till extending to termination depths/auger refusals depths of 2.0 m to 6.4 m (Elevation 115.2 m to Elevation 109.7 m).

Since the issuance of the original report in August 2021, periodic monitoring of the groundwater table in the piezometers/wells installed at the site were collected in 2022 and 2023 with the latest reading taken on June 14, 2023. A review of the latest reading indicates the groundwater at the site to range between 2.2 to 3.1 m depth below ground surface (Elevation 113.82 to 112.72 m)

Provided that all fill and organic soils are removed from the building envelopes and replaced with engineered fill as described in the report, a seismic **Class C** can be used for the site as per Table 4.1.8.4.A of the 2012 Ontario Building Code (as amended May 2, 2019). The subsurface soils are not susceptible to liquefaction during a seismic event.

Compressible clayey soils were not encountered at the site, a grade raise of up to 3.0 m is considered acceptable from a geotechnical perspective.

The heterogenous fill and organic soils are not considered suitable for founding the proposed residential development or as subgrade for the roadways and therefore must be removed and replaced with engineered fill as

discussed in the main body of the report. In addition, following the demolishing of the existing residential structures on-site and the removal of all fill/construction debris down to the surface of the undisturbed native soils, these excavations must also be backfilled with engineered fill.

Footings for the residential apartment building set at Elevation 114.8 m to 115.5 m may be supported by strip footings having a maximum width of 1.5 m bearing and square pad footing having a maximum width and length of 3.0 on the compact sandy silt, compact to very dense glacial till, or well prepared engineered fill pad and designed for a bearing pressure at Serviceability Limit State (SLS) of 150 kPa and a factored geotechnical resistance at ultimate limit state (ULS) of 200 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Settlements of footings designed for the above SLS bearing pressure are expected to be within the tolerable limits of 25 mm total and 19 mm differential. Loose sandy silt layers were contacted in the upper levels of the native soils and may require compaction or removal. Contractors should assume that removal up to the surface of the glacial till will likely be required. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Settlements of footings designed for the above SLS bearing pressure are expected to be within the tolerable limits of 25 mm total and 19 mm differential.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity and to 2.4 m if snow will be removed from the vicinity of the structure.

The basement floors of the new buildings may be designed as a slab-on-grade set on a bed of clear stone placed on the compact native sandy silt or glacial till or on well compacted engineered fill set on the sandy silt or glacial till.

Perimeter and underfloor drainage systems are required for the proposed buildings.

The subsurface basement walls of the new buildings should be backfilled with free draining material, such as OPSS 1010 Granular B Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The expressions provided in the body of the report may be used to compute the lateral static and seismic earth pressures at the subsurface walls.

The excavations for the new buildings, access roads, and underground services are expected to extend to a maximum depth of 4.1 m below the existing ground surface These excavations will extend through the fill, organic soils, and into the native sandy silt and glacial till and they are expected to be up to 2.0 below the groundwater table. These excavations may be undertaken using conventional equipment and should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 4 where organic soils are present and Type 3 where organic soils are not present. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil must be sloped back at 1H:1V from the bottom of the excavation above the groundwater table. Below the groundwater table, the excavations sides are expected to slough and will eventually stabilize at a slope of 2H:1V to 3H:1V. The excavation sides must be cut back at a slope of 3H:1V from the bottom of the excavation to ground surface where organic soils are present.

In areas where the safe slopes cannot be achieved due to the neighboring buildings, such as the case at the southeast and southwest sides of site, support of the excavation sides using shoring may be required.

A pre-construction survey of buildings and infrastructure within the influence zone of the construction should be undertaken prior to start of construction activities including shoring installation activity.

Seepage of the surface and subsurface water into these excavations is anticipated. However, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated. Therefore, the need for high-capacity pumps to keep the excavation dry should not be ignored.

It is anticipated that the majority of the material required for underfloor fill and backfilling purposes would have to be imported and should preferably conform to the specifications discussed in the body of the report.

Pavement structure thicknesses required for the new access road was computed and are provided in the body of the report.

For the purpose of the establishment of the limit of hazardous lands, a slope stability analysis comprising of four (4) cross-sections of the creek were selected and analyzed. A geotechnical set-back line ranging from 0 to 7.5 m was established.

In order to establish the limit of hazardous lands for the proposed development, two other factors in addition to the geotechnical set-back lines have to be taken into consideration. These are toe erosion allowance and erosion access allowance. A site visit was conducted on March 26, 2021 to examine the creek for evidence of any toe erosion. Photographs are presented in Appendix C. Two areas of active erosion of the creek banks have been identified as shown on Figure 2. RVCA allows the provision of toe protection in lieu of toe erosion allowance. It is understood that due to site restrictions, this option was selected by the client to address the observed areas of toe erosion. Therefore, erosion allowance has not been taken into consideration when establishing the limit of hazardous lands which include the geotechnical set-back established plus the access allowance of 6 m which varied from 0 to 13.5 m from the top of the slope bank as shown on Figure 2. EXP can provide further input on design and construction of the toe erosion protection.

Due to the new layout, a limited amount of current test holes are situated within the building envelope, therefore, it is proposed that additional boreholes/test pits are to be completed within the building envelope to collect additional data on the subsurface condition, depth of fill/organic, etc…

The above and other related considerations are discussed in greater detail in the attached report.

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1. Introduction

EXP Services Inc. (EXP) is pleased to present the updated geotechnical investigation and slope stability analysis for the proposed residential development at the property registered by the street address of 37 Wildpine Court, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: P90800GM dated October 21, 2020. It was authorized by Wildpine Trails Inc. (the client) on November 11, 2020. The update was required due to change in the type of the proposed structures at the site, i.e. from residential townhouses blocks to a four (4) storey, 94 unit apartment building with one level of underground parking. and a one semi detached residential building.

The proposed new development as per Site Plan prepared by PMA Architects under their project 21010 dated June 13, 2023 would comprise of a four (4) storey, 94 unit apartment building with one level of underground parking and one semi detached residential building. . The underside of footing and basement of the proposed apartment building will be set at Elevation 114.8 to 115.5 m and Elevation 116.25 m respectively . The underside of footing of the semi-detached building will be set at Elevation 117.0 m. The finished floor of both buildings will be set at Elevation 120.0 m. Underground services, access road and surface parking facility will also be constructed as part of the proposed development.

The site is currently occupied by a residential dwelling, garage, and a metal shed which was demolished to permit the construction of the proposed development. A tributary of Poole creek is situated along the eastern boundary of the site and extends to the northwest side.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at locations of testholes drilled at the site;

b) Provide classification of the site for seismic design in accordance with requirements of the 2012 Ontario Building Code (OBC) as amended May 2, 2019 and assess the liquefication potential of the subsurface soils in a seismic event;

c) Discuss grade raise restrictions;

d) Provide the bearing pressure at Serviceability Limit State (SLS) and factored geotechnical resistance at Ultimate Limit State (ULS) of the most suitable type of foundation for the new buildings, as well as anticipated total and differential settlements;

e) Comment on slab-on-grade construction and permanent drainage requirements;

f) Discuss lateral earth pressure against subsurface walls;

g) Discuss excavation conditions and dewatering requirements during construction of the foundations for the new buildings;

h) Provide pipe bedding requirements for the new underground services;

i) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes;

j) Comment on subsurface concrete requirements and the corrosion potential of subsurface soils to buried metal structures/members;

k) Recommend pavement structure thickness for the new access roads;

l) Establish the limits of hazardous lands from for the proposed development; and,

m) Provide percolation time (T, minutes/cm) for preselected locations and depths.

The comments and recommendations given in this report assume that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The site is located at the dead end of Wildpine Court and is occupied by an abandoned one-storey single family house, a detached garage, and a storage shed, all located at the southwest corner of the property. The remainder of the property consisted of forested wood area and low-lying wetland area. Surrounding properties consist of residential and commercial properties to the north, west, and south. Part of Poole Creek and wetlands are present on the east property line and extends through the site to the northwest side of the development.

The site is gently undulating downward towards the creek with ground surface elevations ranging between 115.67 m and 117.88 m at the testhole locations.

3. Procedure

The fieldwork for the geotechnical investigation was completed on December 11 and 18, 2020 and May 5, 2021 and consists of eighteen (18) testholes (Borehole Nos. 2 to 4, Borehole Nos. 6 to 8, and Test Pit Nos. 1 to 7, 1A, 2A, 4A, 4B, and 4C). The testholes were advanced to depths ranging between 1.1 m and 6.4 m below the existing ground surface. The boreholes were drilled using a track-mounted drill rig whereas the test pits were excavated using an excavator. The fieldwork was supervised on a full-time basis by a representative from EXP.

The locations of the boreholes were established on site by EXP. The geodetic ground surface elevation at the locations of Borehole Nos. 2 to 4, Borehole Nos. 6 to 8, and Test Pit Nos. 1 to 7 was surveyed by EXP. The geodetic ground surface elevation at the locations of Test Pit Nos. 1A, 2A, 4A, 4B, and 4C was estimated from the spot elevations shown on the topographic survey plan dated January 7, 2021 and prepared by Annis, O'Sullivan, Vollebekk Ltd. Therefore, the elevations presented on these testholes should be considered approximate. The testhole locations are shown in Figure 2.

Prior to the fieldwork, the locations of the testholes were cleared of any public and private underground services. Standard penetration tests (SPTs) were performed in the boreholes at approximately 0.75 m depth intervals and the soil samples were retrieved by the split-barrel sampler. Grab samples were collected from selected depths from the test pits.

A 19 mm diameter standpipe with slotted section was installed in each of Borehole Nos. 2, 4, 6, and 8 for long-term monitoring of the groundwater table at the site. The standpipes were installed in accordance with EXP standard practice and the installation configuration is documented on the respective borehole logs. The testholes were backfilled upon completion of drilling, the installation of the standpipes, or upon the completion of excavation.

All soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified. On completion of the fieldwork, all the soil samples were transported to the EXP laboratory in the City of Ottawa, Ontario, where they were visually examined by a geotechnical engineer, and borehole logs were prepared. The engineer also assigned the laboratory testing which consisted of performing the following tests on soil samples:

Natural Moisture Content……. .....60 Tests

Grain Size Analysis……7 Tests

Chemical Analysis (pH, sulphate, chloride and resistivity) ……2 Tests

Organic Content……2 Tests

4. Subsurface Soil and Groundwater Conditions

A detailed description of the geotechnical conditions encountered in the testholes is given on the testhole logs, Figures 3 to 15, 4A, 5A, 10A, 12A, and 15A. The testhole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time may also result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

The testholes were drilled or excavated to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of environmental conditions.

It should be noted that the soil boundaries indicated on the testhole logs are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Descriptions" preceding the testhole logs forms an integral part of this report and should be read in conjunction with this report.

A review of the testhole logs indicates the following subsurface soil conditions with depth and groundwater level measurements.

4.1 Topsoil

A 100 mm to 300 mm thick topsoil was contacted at ground surface in all testholes except Borehole Nos. 3 and 4 and Test Pit No. 7.

4.2 Pavement Structure

A 60 mm thick asphalt pavement underlain by 540 mm thick silty sand with gravel granular fill was contacted at ground surface in Borehole No. 3.

4.3 Fill

Silty sand with gravel fill was contacted at ground surface in Borehole No. 4 and Test Pit No. 7 and beneath the topsoil and pavement structure in all other testholes. The fill extends to termination depths of 1.1 to 2.4 m (Elevation 115.6 m and Elevation 115.4 m) in Test Pit No. 3, 4B, and 4C and to depths ranging from 0.9 m to 3.0 m below existing grade (Elevation 113.3 m to Elevation 116.7 m) in all other testholes. It is generally organic and contains cobbles and boulders, topsoil, and tree roots in all testholes and construction debris such as concrete, asphalt, and brick pieces and insulation in Test Pit Nos. 1, 1A, 2, 2A, 4C, 6, and 7. It is in a very loose to very dense state and has a natural moisture content ranging from 3.3 to 33.2 percent. The fill has a moisture content of 334.0 percent in Test Pit No. 1 indicating a high organic content.

Grain size analysis was conducted on two (2) samples of the fill and the grain size distribution curves are shown in Figure Nos. 16 and 17 and results summarized in Table I.

Table I: Summary of Grain-size Analysis Results – Fill Samples						
Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification (USCS)
		Gravel	Sand	Silt	Clay	
BH-2 – SS2	0.8 – 1.4	15	43	41	1	Silty Sand with Gravel (SM)
BH-7 – SS2	0.8 – 1.4	15	46	29	10	Silty Sand with Gravel (SM)

Based on the results of the grain size analysis, the fill may be classified as a silty sand with gravel (SM) in accordance with the Unified Soil Classification System (USCS).

4.4 Organic Silty Sand to Sandy Silt (Peat-Like)

The fill in Borehole Nos. 2, 3, 7, and 8 and in Test Pit Nos. 1A, 1, 2, 4, 6, and 7 was underlain by 0.3 m to 1.9 m thick layer of organic silty sand to sandy silt peat-like deposit containing decayed wood and topsoil. This deposit extends to depths ranging from 1.9 m to 4.1 m below existing grade (Elevation 112.3 m to Elevation 114.8 m). This deposit extends to the test pit termination depth at 2.5 m (Elevation 113.6 m) in Test Pit No. 1A. It is in a very loose to loose state and has a natural moisture content ranging from 13.7 percent to 240.5 percent.

Grain size analysis and organic content were conducted on two (2) samples from this deposit and the grain size distribution curves are shown in Figure Nos. 18 and Figure 19 and summarized in Table II.

Table II: Summary of Grain-size Analysis and Organic Content Results – Organic Silty Sand to Sandy Silt Samples								
Borehole No. – Sample No.	Depth (m)	Moisture Content (%)	Organic Content (%)	Grain-size Analysis (%)				Soil Classification (USCS)
				Gravel	Sand	Silt	Clay	
BH-2 – SS4	2.3 – 2.9	89.4	14.4	0	59	34	7	Organic Silty SAND (SM)
BH-3 – SS5	3.0 – 3.6	174.1	27.7	0	36	58	6	Organic Sandy SILT (ML)

Based on the results of the grain size analysis, the soil may be classified as organic silty sand to sandy silt (SM to ML) in accordance with the Unified Soil Classification System (USCS).

4.5 Sandy Silt (ML)

The organic silty sand to sandy silt peat-like deposit in Borehole Nos. 2, 3, 7, and 8 and in Test Pit Nos. 1, 2, and 6, and the fill in Test Pit No. 2A is underlain by sandy silt with trace to some gravel which extends to depths of 5.1 m and 5.8 m (Elevation 110.6 m and Elevation 110.3 m) in Borehole Nos. 2 and 7, to termination depth at 5.2 m (Elevation 111.4 m) in Borehole No. 3, to auger refusal at 5.9 m depth (Elevation 109.9 m) in Borehole No. 8, and to termination depths ranging from 2.0 m to 4.0 m (Elevation 114.0 m to Elevation 111.9 m) in Test Pit Nos. 1, 2, 2A,

and 6. It is in a compact state as indicated by the SPT N-values of 12 to 25 and has a natural moisture content ranging from 11.5 to 41.0 percent. Grain size analysis was conducted on two (2) sample of the sandy silt and the grain size distribution curves are shown in Figure 20 and Figure 21 and the test results are summarized in Table III.

Table III: Summary of Grain-size Analysis Results – Sandy Silt Samples

Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)				Soil Classification (USCS)
		Gravel	Sand	Silt	Clay	
BH-3 – SS7	4.6 – 5.2	1	26	68	5	Sandy SILT (ML)
BH-8 – SS6	3.8 – 4.4	0	36	59	5	Sandy SILT (ML)

Based on the results of the grain size analysis, the soil may be classified as a sandy silt (ML) in accordance with the Unified Soil Classification System (USCS).

4.6 Glacial Till

The fill in Borehole Nos. 4 and 6 and Test Pit Nos. 4A and 5, the organic silty sand to sandy silt in Test Pit Nos. 4 and 7, and the sandy silt in Borehole No. 2 are underlain by silty sand with gravel glacial till. The glacial till contains numerous cobbles and boulders and extends to termination depths at 4.2 m to 5.2 m (Elevation 112.5 m to Elevation 110.5 m) in Borehole Nos. 2, 4, and 6, to auger refusal at 6.4 m depth (Elevation 109.7 m) in Borehole No. 7, and to termination depths at 2.0 m to 3.0 m (Elevation 115.2 m to Elevation 113.2 m) in Test Pit Nos. 4A, 4, 5, and 7. The till is a compact to very dense state and has a natural moisture content ranging from 3.7 to 19.7 percent.

Grain size analysis was conducted on one (1) sample of the glacial till and the grain size distribution curve is shown in Figure 22 and the test results are summarized in Table IV.

Table IV: Summary of Grain-size Analysis Results – Glacial Till Sample

Borehole No. – Sample No.	Depth (m)	Grain-size Analysis (%)			Soil Classification (USCS)
		Gravel	Sand	Silt and Clay	
BH-4 – SS3	1.5 – 2.1	39	48	13	Silty Sand with Gravel (SM)

Based on the results of the grain size analysis, the glacial till may be classified as silty sand with gravel (SM) in accordance with the Unified Soil Classification System (USCS).

4.7 Groundwater Level

Groundwater levels were recorded on the test pits and boreholes excavation (unstabilized) and in standpipes installed in selected boreholes (stabilized). In addition, periodic readings have been collected in 2022 and 2023 with the latest reading taken on June 14, 2022. A selective representative summary of the groundwater depths and elevations measurements taken to date after installation is shown in Table V.

Table V: Summary of Groundwater(GWT) Depths and Elevations Measurements			
Borehole No.	**GS Elevation (m)**	**Depth (Elevation) of GWT Level (m)**	**Measurement Date**
BH-2	115.70	2.4 (113.30)	January 5, 2021
		2.4 (113.30)	May 7, 2021
		2.25 (113.45)	March 30, 2022
		2.29 (113.41)	February 15, 2023
		3.16 (113.41)	March 30, 2023
		2.35 (113.35)	April 27, 2023
		2.35 (113.35)	May 30, 2023
		2.38 (113.32)	June 14, 2023
BH-4	116.72	2.7 (114.02)	January 5, 2021
		2.7 (114.02)	May 7, 2021
		Destroyed	March 30, 2023
BH-6	116.19	2.3 (113.89)	January 5, 2021
		2.3 (113.89)	May 7, 2021
		2.02 (114.17)	March 30, 2022
		2.17 (114.02)	February 15, 2023
		1.95 (114.24)	March 30, 2023
		2.09 (114.10)	April 27, 2023
		2.19 (114.00)	May 30, 2023
		2.24 (113.95)	June 14, 2023
BH-8	115.79	2.9 (112.89)	January 5, 2021
		2.8 (112.99)	May 7, 2021
		2.71 (113.08)	March 30, 2022
		2.88 (112.91)	February 15, 2023
		2.71 (113.08)	March 30, 2023
		2.93 (112.86)	April 27, 2023
		3.03 (112.76)	May 30, 2023
		3.07 (112.72)	June 14, 2023

A review of the above table shows that the groundwater at the site is at a depth of 2.2 to 3.1 m (Elevation 113.95 m to 112.72 m) approximately 900 days following the installation.

Groundwater levels were determined in the boreholes at the times and under the conditions stated in the scope of services. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

5. Seismic Site Classification and Liquefaction Potential of Soils

The investigation has revealed the subsurface condition comprises of fill, organic silty sand and sandy silt (peat like) overlain by silty sand glacial till. The fill and organic soils are not suitable for founding purposes and must be removed to the surface of the native soils and replaced with engineered fill as described in Section 7 of the report.

5.1 Site Classification for Seismic Site Response

Provided that all organic soils are removed from the underside of footings , Seismic **Class C** may be used for the site in accordance with Table 4.1.8.4.A in the 2012 Ontario Building Code (as amended May 2, 2019).

5.2 Liquefaction Potential of Soils

The subsurface soils are not susceptible to liquefaction during a seismic event.

6. Grade Raise Restrictions

The investigation has revealed the site is generally underlain by fill, organic silty sand to sandy silt, sandy silt, and glacial till.

It is anticipated that a grade raise ranging between 1 and 3 m will be required. This grade raise is considered acceptable from a geotechnical point of view provided any loose or compressible material are removed from the envelope of the proposed building.

Removal of fill and organic soils will be required in the areas of footings and roadways prior to placement of any additional fill as described in the sections below. For general guidance purposes and following removal of the fill and organic soils, the excavation should be backfilled using OPSS 1010 Granular B Type II under structural elements and with OPSS Select Subgrade Material (SSM) or on-site non-organic soils under the pavement.

7. Foundation Considerations

The underside of footing and basement of the proposed apartment building will be set at Elevation 114.8 to 115.5 m and Elevation 116.25 m respectively . The underside of footing of the semi-detached building will be set at Elevation 117.0 m. The finished floor of both buildings will be set at Elevation 120.0 m.

The investigation has revealed that the subsurface condition to comprise of fill, organic silty sand to sandy silt, sandy silt which is loose in upper levels and glacial till. The fill and organic soils are not suitable founding material and must be removed to the surface of the undisturbed sandy silt/glacial till and replaced with engineered fill. Similarly, fill materials and construction debris in the areas of the existing structures must be removed to the surface of the undisturbed sandy silt/glacial till and replaced with engineered fill. It is noted that the upper layers of the native soils were loose and may require removal or compaction prior to the placement of the engineered fill. This requirement will be best established during the excavation process. Contractors should assume that removal up to the surface of the glacial till will likely be required within the envelope of the proposed building.

The engineered fill pad must extend to 0.6 m beyond the edge of the footings and then slope down at a gradient of 1H:1V. Following approval of the subgrade by a geotechnician, OPSS 1010 Granular B Type II should be placed in 300 mm lifts and each lift compacted to 100 percent of the standard Proctor maximum dry density (SPMDD) in accordance with ASTM D-698-12e2. In-Place density tests must be conducted on each lift to ensure that the specified degree of compaction has been achieved.

Footings for the residential apartment building set at Elevation 114.8 m to 115.5 m may be supported by strip footings having a maximum width of 1.5 m bearing and square pad footing having a maximum width and length of 3.0 on the compact sandy silt, compact to very dense glacial till, or well prepared engineered fill pad and designed for a bearing pressure at Serviceability Limit State (SLS) of 150 kPa and a factored geotechnical resistance at ultimate limit state (ULS) of 200 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Settlements of footings designed for the above SLS bearing pressure are expected to be within the tolerable limits of 25 mm total and 19 mm differential.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided. EXP can provide additional comments in this regard, if required.

The founding surfaces should be reviewed and approved by a geotechnician prior to placement of concrete and or placement and compaction of the engineered fill.

The recommended bearing pressure at SLS and factored geotechnical resistances at ULS have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

8. Slab-on-Grade Construction

The basement floors of the new buildings may be designed as a slab-on-grade set on a bed of clear stone placed on the native sandy silt, glacial till, or well compacted engineered fill set on the compact sandy silt or glacial till prepared as described in Section 7. Any loose sandy silt encountered at the basement level must be comapcted or rempoved and replaced with engineered fill.

Perimeter and underfloor drainage systems are recommended for the proposed building. For general guidance, the drainage systems may consist of a 100 mm perforated pipes wrapped with filter cloth (sock) and set on the foundations or under the slab-on-grade and surrounded with 150 mm of 19 mm clear stone and properly connected to an outflow. It is recommended that the perimeter and underfloor drainage systems be connected to separate outflows.

The ground floor of the new buildings should be at least 150 mm above the finished exterior grade. The finished exterior grade should be sloped away from the buildings to prevent ponding of surface water close to the exterior walls.

9. Lateral Earth Pressure to Subsurface Walls

The subsurface basement walls of the new buildings should be backfilled with free draining material, such as OPSS 1010 Granular B Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The walls will be subjected to lateral static and dynamic (seismic) earth forces. The expressions below assume free draining backfill material, a perimeter drainage system, level backfill surface behind the wall and vertical face on the back side of the wall.

For design purposes, the lateral static earth thrust against the subsurface walls may be computed from the following equation:

$$P = K_0 h (½ \gamma h + q)$$

where P = lateral earth thrust acting on the subsurface wall; kN/m

K_0 = lateral earth pressure coefficient for 'at rest' condition for Granular B Type II backfill material = 0.50

γ = unit weight of free draining granular backfill; Granular B Type II = 22 kN/m^3

h = depth of point of interest below top of backfill, m

q = surcharge load stress, kPa

The lateral seismic thrust may be computed from the equation given below:

$$\Delta_{Pe} = \gamma H^2 \frac{a_h}{g} F_b$$

where Δ_{Pe} = dynamic thrust in kN/m of wall

H = height of wall, m

γ = unit weight of backfill material = 22 kN/m^3

$\frac{a_h}{g}$ = seismic coefficient = 0.32

F_b = thrust factor = 1.0

The dynamic thrust does not take into account the surcharge load. The resultant force acts approximately at 0.63H above the base of the wall.

All subsurface walls should be properly waterproofed.

10. Excavation and De-Watering Requirements

10.1 Excess Soil Management

A new Ontario Regulation 406/19 made under the Environmental Protection Act (November 28, 2019) has been implemented as of January 1, 2021. The new regulation dictates the testing protocol that is required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

Reference is made to the Phase II ESA report completed by EXP in October 10, 2021.

10.2 Excavations

Excavations for the new buildings, access roads, and underground services including the removal of the fill materials and organic soils will extend to a maximum depth of 4.1 m below the existing ground surface and are expected to be up to 2.0 m below the groundwater level.

Excavations through the overburden material (fill and glacial till) may be undertaken using conventional equipment capable of removing construction debris, cobbles, and boulders. All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 4 where organic soils are present and Type 3 where organic soils are not present. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil must be sloped back at 1H:1V from the bottom of the excavation above the groundwater table. Below the groundwater table, the excavations sides are expected to slough and will eventually stabilize at a slope of 2H:1V to 3H:1V. The excavation sides must be cut back at a slope of 3H:1V from the bottom of the excavation to ground surface where organic soils are present.

In areas where the safe slopes cannot be achieved due to the neighboring buildings, such as the case at the southeast and southwest sides of site, support of the excavation sides using shoring may be required. The need for a shoring system, the most appropriate type of shoring system and the design and installation of the shoring system should be determined by the contractors bidding on this project. The design of the shoring system should be undertaken by a professional engineer experienced in shoring design and the installation of the shoring system should be undertaken by a contractor experienced in the installation of shoring systems. The shoring system should be designed and installed in accordance with latest edition of Ontario Regulation 213/91 under the OHSA and the 2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM). It must be noted that OHSA does not allow the use of prefabricated shoring system in Type 4 soil.

The shoring system as well as adjacent settlement sensitive structures (buildings) and infrastructure should be monitored for movement (deflection) on a periodic basis during construction operations.

A pre-construction survey of buildings and infrastructure within the influence zone of the construction should be undertaken prior to start of construction activities including shoring installation activity.

It is recommended that vibration monitoring be conducted at the site and at adjacent existing buildings and infrastructure during the installation of the shoring system and during construction of the new building to ensure the existing structures and infrastructure are not damaged as a result of the construction activities and shoring installation.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

10.3 De-Watering Requirements and Impact on Surrounding Structures and Infrastructure

For excavations extending to 4.1 m below the existing grade, the excavations are anticipated to be approximately 1.8 m below the groundwater level. Therefore, the removal of groundwater from the excavation will be required.

Seepage of the surface and subsurface water into these excavations is anticipated. However, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated. Therefore, the need for high-capacity pumps to keep the excavation dry should not be ignored.

It has been assumed that the maximum excavation depth at the site will be approximately 4.1 m and groundwater removal is anticipated to be required. Therefore, it is noteworthy to mention that new legislation came into force in Ontario on March 29, 2016, to regulate groundwater takings for construction dewatering purposes. Prior to March 29, 2016, a Category 2 Permit to Take Water (PTTW) was required from the Ontario Ministry of the Environment and Climate Change (MOECC) for groundwater takings related to construction dewatering, where taking volumes in excess of 50 m3/day, but less than 400 m3/day, and the taking duration was no more than 30 consecutive days. The new legislation replaces the Category 2 PTTW for construction dewatering with a new process under the Environmental Activity and Sector Registry (EASR). The EASR is an on-line registry, which allows persons engaged in prescribed activities, such as water takings, to register with the MOECC instead of applying for a PTTW.

To be eligible for the new EASR process, the construction dewatering taking must be less than 400 m3/day under normal conditions. The water taking can be groundwater, storm water, or a combination of both. It should be noted that the 30-consecutive day limit on the water taking under the old Category 2 PTTW process has been removed in the new EASR process. Also, it should be noted that the EASR process requires two technical studies be prepared by a Qualified Person, prior to any water taking. These studies include a Water Taking Report, which provides assurance that the taking will not cause any unacceptable impacts, and a Discharge Plan, which provides assurance that the discharge will not result in any adverse impacts to the environment. EXP has qualified persons who can prepare these types of reports, if required. A significant advantage of the new EASR process over the former Category 2 PTTW process, is that the groundwater taking may begin immediately after completing the on-line registration of the taking and paying the applicable fee, assuming the accompanying technical studies have been completed. The former PTTW process typically took more than 90 days, which had the potential to impact construction schedules.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to adequately engineer construction dewatering systems.

11. Pipe Bedding Requirements

It is recommended that the bedding for underground services including material specifications, thickness of cover material, and compaction requirements conform to City of Ottawa requirements and/or Ontario Provincial Standard Specification and Drawings (OPSS and OPSD).

The pipe subgrade material is anticipated to be sandy silt or glacial till. In areas where organic soils are encountered at invert level, they must be removed to the surface of the sandy silt or glacial till and replaced with engineered fill comprising of OPSS 1010 Granular B Type II placed in 300 mm lifts and each lift compacted to 95 percent of SPMDD. It is recommended the pipe bedding should consist of 300 mm thick OPSS 1010 Granular A compacted to at least 98 percent SPMDD. The bedding material should be also placed along the sides and on top of the pipes to provide a minimum cover of 300 mm. The bedding, spring line and cover should be compacted to at least 98 percent SPMDD.

12. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The material to be excavated from the site will consist of silty sand with gravel fill, granular fill, organic silty sand to sandy silt, sandy silt, and silty sand with gravel glacial till. The fill is generally organic and contains occasional cobbles and boulders, topsoil, wood chips, tree roots, and construction debris such as concrete and asphalt pieces and insulation.

The organic silty sand to sandy silt (peat-like) soils are not suitable for use as backfill and may be used as fill in landscaped areas if mixed with other on-site soils to reduce the organic contents. The fill overlying the organic soils is also not suitable for use as structural fil and can also be used as fill in landscaped areas. However, it may be possible to use some of the existing fill as subgrade in access roads following the removal of the organic soils provided that any organics, debris, and other unsuitable materials are removed from it. Additional evaluation must be completed following excavation and stockpiling of the fill material to assess the potential of re-using some of the existing fill as subgrade material. The native sandy silt and glacial till from above the groundwater table may be used as backfill of service trenches outside the buildings. However, these soils are susceptible to moisture absorption due to precipitation and must be protected if stockpiled on-site for re-use. The rest of the excavated material may be used also for general grading purposes in landscaped areas.

It is anticipated that the majority of the material required for backfilling purposes would have to be imported and should preferably conform to the following specification:

- Engineered fill under the slab-on-grade area and footings - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 and 100 percent SPMDD respectively.
- Backfill in footing trenches and against foundation walls – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD inside the building and 95 percent SPMDD outside the building respectively.
- Backfill in services trenches inside buildings – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD.
- Backfill in exterior services trenches or subgrade fill– OPSS 1010 Select Subgrade Material (SSM) placed in 300 mm thick lifts and each lift compacted to 95 percent of the SPMDD or on-site approved excavated material as noted above.
- Trench backfill and subgrade fill, select on-site material free if organics, boulders and cobbles and following further sampling and testing during construction.

13. Subsurface Concrete and Steel Requirements

Chemical tests limited to pH, chloride, sulphate and resistivity were performed on two (2) selected soil sample. The certificate of the laboratory analysis is attached in Appendix A and the results are summarized in Table VI.

Table VI: Chemical Test Results on Soil Sample

Borehole No. (Sample No.)	Soil Type	Depth (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH-4 (SS4)	Glacial Till	2.3 – 2.6	8.38	0.0023	0.0017	6370
BH-7 (SS5)	Organic Silty and to Sandy Silt	3.0 – 3.6	7.27	0.0073	0.0121	2160

The test results indicate the sulphate content in the glacial till and the organic silty sand to sandy silt is 0.0023 percent and 0.0073 percent respectively or less than 0.1 percent. These concentrations would have negligible potential of sulphate attack on subsurface concrete. The concrete should be designed in accordance with Table Nos. 3 and 6 of CSA A.23.1-14. However, the concrete should be dense, well compacted and cured.

Based on a review of the resistivity test result, the glacial till and the organic silty sand to sandy silt samples are considered mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be undertaken to protect buried steel elements from corrosion.

14. Pavement Structure

Pavement structure thickness required for the new access road was computed and is shown on Table VII. The thicknesses are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples and pavement functional design life of ten to fifteen (10 to 15) years. The proposed functional design life represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. The subgrade is anticipated to consist of the native sandy silt, glacial till, or select subgrade material (SSM).

Table VII: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Heavy Duty Traffic (trucks)
Asphaltic Concrete (PG 58-34)	92 - 97 percent MRD*	40 mm HL3/SP12.5 Cat B 50 mm HL8 or SP 19 Cat B
OPSS 1010 Granular A Base	100 percent SPMDD**	150 mm
OPSS 1010 Granular B Type II Sub-Base	100 percent SPMDD**	450 mm

**Denotes maximum relative density.*

*** Denotes standard Proctor maximum dry density, ASTM-D698-12e2.*

Construction procedures for the pavement structure are discussed below.

The foregoing design assumes that construction is carried out during dry periods and that the subgrade is undisturbed under the load of construction equipment. If construction is carried out during wet weather, and heaving or rolling of the subgrade is experienced, additional thickness of granular material and/or geotextile may be required.

Additional comments on the construction of the new access roads are as follows:

- As part of the subgrade preparation for the new pavement, the pavement area should be stripped of existing fill materials, asphalt, topsoil and organic soils, and other obviously unsuitable material down to subgrade level. In areas where organic soils were encountered, they should also be removed and replaced with approved non-organic soils placed in 300 mm lift and each lift compacted to 95 percent of the SPMDD. The subgrade should be properly shaped, crowned, then proofrolled using a ten (10) vibratory roller in the full-time presence of a representative of this office. Any loose, soft, or spongy subgrade areas detected should be sub-excavated and replaced OPSS 1010 Granular B Type II material placed in 300 mm lifts and each lift compacted to 95% of the SPMDD in accordance with ASTM D698-12e2.

- It is noted that the long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. Therefore, it is recommended that sub-drains should be installed and connected between catchbasins. This will ensure no water collects in the granular course, which could result in pavement distress during the spring thaw.

- To minimize the problems of differential movement between the pavement and catchbasins/manhole due to frost action, the backfill around the structures should consist of free-draining granular preferably conforming to OPSS Granular B Type II material. Care should be taken to ensure that the fill around the services installation (catchbasins and manholes) is properly compacted using smaller compaction equipment's. Weep holes should be provided in the catchbasins/manholes to facilitate drainage of any water that may accumulate in the granular fill.

- The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, temporary construction roadways, etc., may be required, especially if construction is carried out during unfavorable weather.

- The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum cross fall of 2 percent) to provide effective surface drainage towards catch basins. Surface water should not be allowed to pond adjacent to the outside edges of paved areas.

- Relatively weaker subgrade may develop over service trenches at subgrade level. Therefore, only compactible and dry soil should be used as backfill in the services trenches. The use of a geotextile may be required at subgrade level and should be allowed for as a provisional item in the contract.

- The granular materials used for pavement construction should conform to Ontario Provincial Standard Specifications (OPSS 1010) for Granular A and Granular B Type II and should be compacted to 100 percent of the SPMDD. The asphaltic concrete used and its placement should meet OPSS 1150 or 1151 requirements. It should be compacted from 92 percent to 97 percent of the MRD (ASTM D2041). Asphalt placement should be in accordance with OPSS 310 and OPSS 313.

- It is recommended that EXP be retained to review the final pavement structure design and drainage plans prior to construction to ensure they are consistent with the recommendations of this report.

15. Slope Stability Analysis and Limits of Hazardous Lands

15.1 Slope Stability Analysis

Poole creek tributary borders the site along the east and northwest boundaries. In order to establish the limit of development form top of the creek top of bank, a slope stability analysis was undertaken. A total of four (4) critical cross-sections were selected and analysed (cross-section A to D) as shown on Figure No. 2. The height and gradient of the slopes of the selected cross-sections ranged from 1.6 m to 2.2 m and 1.9H:1V to 6.1H:1V respectively.

The slope profiles were established using data presented on the topographic survey plan dated January 7, 2021 by Annis, O'Sullivan, Vollebekk Ltd. provided to EXP. The subsurface profiles were established during the data collected from the testholes completed by EXP as part of the geotechnical investigation.

The stability of the creek slope at the selected cross-sections was analysed using Bishop and Price method with the aid of a computerized program for the following conditions:

(1) Total Stress Analysis;

(2) Total Stress Analysis with seismic loading; and,

(3) Long-term stability of slope using effective stress analysis.

The following soil properties were used in slope stability analysis. The properties used in the slope stability analysis were selected based on previous experience with similar site and source of the published literature.

Table VIII: Engineering Properties of Soils for Slope Stability Analysis

Soil Type	Unit Weight (kN/m^3)	Angle of Internal Friction, Phi (degrees)
FILL: silty sand with gravel (SM)	18 - 19	32
Organic Silty Sand to Sandy Silt (SM to ML)	16.5 - 17.5	27 - 31
Sandy SILT (ML)	19	32

It is noted that the current City of Ottawa guidelines require a factor of safety of 1.5 against slope failure for static analysis and a factor of safety of 1.1 against slope failure under seismic conditions.

Table IX presents the required geotechnical set-back which will produce safety factors which meets the City of Ottawa requirement of 1.5 and 1,1 for static and seismic loading conditions respectively.

Table IX: Results of Slope Stability Analysis and Geotechnical Setback						
Cross-Section	Height (m)	Gradient	Conditions Analysed	Computed Factor of Safety	Figure No.	Geotechnical Setback (m)
A	1.9	3.4H:1V	Total stress analysis	2.08	23a	7.3
			Total stress analysis with seismic loading	1.29	23b	
			Effective stress analysis	1.50	23c	
B	2.1	2.6H:1V	Total stress analysis	1.75	24a	7.5
			Total stress analysis with seismic loading	1.14	24b	
			Effective stress analysis	1.49	24c	
C	1.6	1.9H:1V	Total stress analysis	1.50	25a	5.8
			Total stress analysis with seismic loading	1.10	25b	
			Effective stress analysis	1.48	25c	
D	2.2	6.1H:1V	Total stress analysis	3.54	26a	0
			Total stress analysis with seismic loading	1.75	26b	
			Effective stress analysis	1.62	26c	

A review of Table IX indicates a geotechnical setback ranging between 5.8 and 7.5 was established to be required form top of back at cross-sections A, B, and C. No geotechnical setback is required at cross-section D.

15.2 Limits of Hazardous Lands

In order to establish the limit of hazardous lands in addition to the geotechnical set-back, two other factors have to be taken into consideration. These are toe erosion allowance and erosion access allowance. The magnitude of the toe erosion allowance depends on the type of soils forming the creek slope, channel width, quantity and velocity of water flow, and the state of erosion along the creek bank. The Ontario Ministry of Natural Resources procedures permit either the installation of erosion protection or the consideration of toe erosion allowance.

A site visit was conducted on March 26, 2021, to examine the creek for evidence of any toe erosion. Photographs are presented in Appendix C. Two areas of active erosion of the creek banks have been identified as shown on Figure

2. RVCA allows the provision of toe protection in lieu of toe erosion allowance. It is understood that due to site restrictions, this option was selected by the client to address the observed areas of toe erosion. Therefore, erosion allowance has not been taken into consideration when establishing the limit of hazardous lands which include the geotechnical set-back established plus the access allowance of 6 m as shown on Figure 2. EXP can provide further input on design and construction of the toe erosion protection.

The crest of the slope was surveyed by a registered Ontario Land Surveyor and is shown on the site plan. This crest was used to plot the limit of hazardous lands. The limit of hazardous lands should be staked out in the field by a registered Ontario Land Surveyor as shown on Figure 2. No development should take place within the hazardous land.

During construction, the following precautions should be taken so that the stability of the slopes is not adversely affected.

1. Care should be exercised during construction to ensure that the existing slopes are not steepened by placement of fill close to the crest of the slope since this would reduce the stability of the slope.
2. Excavations should not be undertaken at the toe of the slopes since this would adversely affect the stability of the slopes.
3. Natural drainage paths should not be blocked by placement of fill on the slope. If fill must be placed on the slope, adequate drainage should be provided to prevent buildup of pore pressures in the soil.
4. Vegetation should not be removed from the faces of the slopes as they protect the face of the slope from erosion. Additional vegetation should be planted on the slopes when necessary.

16. Infiltration Rate

It is our understanding that an estimate of the infiltration rate of the subsurface soils is required for stormwater management design for the proposed residential development. The infiltration rate of the subsurface soils was estimated from the percolation time of the subsurface soils. The percolation time of the subsurface soils was determined by conducting falling head test in five (5) test pits at locations and depths selected by the civil engineer as shown in Figure 2.

The procedure for the falling head test involved the excavation of a large test pit to depths ranging from 0.9 m to_2.0 m below existing grade using an excavator. At the bottom of each test pit a cone-shaped 300 mm diameter by 300 mm deep test pit was excavated using a hand shovel. The falling head test was conducted by filling the cone-shaped hole in the bottom of the test pit with water and recording the drop in the water level over time. In Test Pit Nos. 1A and 4A, the falling head test was conducted at two (2) different depths within the testpit. Upon completion of the percolation test, each test pit was backfilled and the backfill nominally packed in place using the excavator bucket.

A summary of the percolation time determined from the falling head test at each test pit location and depths and the estimated infiltration rate are summarized in Table X. The infiltration rate for a given percolation time was estimated from Table C1 provided in Appendix C of the document titled, “Low Impact Development Stormwater Management Planning and Design Guide”.

Table X: Summary of Percolation Time and Infiltration Rate of Soils

Test Pit No.	Depth of Bottom of Large Test Pit (m)	Soil Type Exposed in Cone-Shaped Test Pit	Percolation Time, T (mins/cm) From Falling Head Test	Estimated Infiltration Rate, 1/T (mm/hr)
TP-1A	0.9	Fill: silty sand with gravel (SM)	22	29
TP-1A	2.0	Fill: silty sand with gravel (SM)	5	131
TP-2A	2.0	Sandy Silt, some gravel (ML)	47	14
TP-4A	1.1	Fill: silty sand with gravel (SM), with organics	<2	>300
TP-4A	2.0	Glacial Till: silty sand with gravel (SM)	<2	>300
TP-4B	1.1	Fill: silty sand with gravel (SM)	24	28
TP-4C	1.1	Fill: silty sand with gravel (SM)	3	225

17. General Comments

The comments given in this report are intended only for the guidance of design engineers. The number of testholes required to determine the localized underground conditions, between testholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well, as their own interpretations of the factual testhole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report is not intended to reflect on environmental aspects of the soils and groundwater. Should specific information be required, including for example the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

Due to the new layout, limited amount of current test holes are situated within the building envelope, therefore, it is proposed that an additional boreholes/test pits be completed within the building envelope to collect additional data on the subsurface condition, depth of fill/organic, etc…

We trust that the information contained in this report is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely.

Ismail Taki, M.Eng., P.Eng.
Manager, Geotechnical Services
Earth and Environment

Figures

0 25m 50m 100m

HORIZONTAL 1:2500

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DESIGN	---
DRAWN	A.C.
DATE	01-20-21
FILE NO	263154

CLIENT: WILD PINE TRAILS INC.

TITLE: PROPOSED RESIDENTIAL DEVELOPMENT
GEOTECHNICAL INVESTIGATION-SITE LOCATION PLAN
37 WILDPINE COURT, OTTAWA, ON

SCALE 1:5000

SKETCH NO FIG 1

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PROJECT BOUNDARY

AREAS OF ACTIVE EROSION

LOT
PIN: 04459 - 0068

LOT 1
AREA : 5660 m²

LOT 2
AREA : 709 m²

4 STORY
APARTMENT BUILDING
94 UNITS

Proposed
Semi-Detached

WILDPINE COURT

TOP OF SLOPE

SETBACK

EROSION ALLOWANCE

BH-1 116.12
BH-2 115.70
BH-3 116.58
BH-4 116.72
BH-4B 116.72
BH-5 117.58
BH-6 116.19
BH-7 116.09
BH-8 115.79
TP-1 116.07
TP-1A 116.07
TP-2 115.67
TP-2A 116.02
TP-3 117.88
TP-4 116.50
TP-4A 116.35
TP-4C 116.50
TP-5 117.58
TP-6 115.86
TP-7 116.66
TP-8 115.83
TP-13 116.19

0 5m 10m 30m
HORIZONTAL 1:750

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR 3 MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED PERIOD IS REQUIRED.
3. TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLE LOCATIONS.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONSTRUCTION WITH THIS REPORT.

LEGEND

BH-1 116.12 — BOREHOLE LOCATION, NUMBER AND SURFACE ELEVATION

TP-1 116.07 — TEST PIT LOCATION, NUMBER AND SURFACE ELEVATION

8 – 10 METRE GEOTECHNICAL SETBACK

1 METRE EROSION ALLOWANCE

6 METRE EROSION ACCESS ALLOWANCE

30 METRE SETBACK FROM WETLANDS

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN	I.T.
DRAWN	G.C./A.S.
DATE	JUNE 2023
FILE NO	OTT-00263154-A0

CLIENT: WILD PINE TRAILS INC.

TITLE: PROPOSED RESIDENTIAL DEVELOPMENT
GEOTECHNICAL INVESTIGATION – TEST HOLE LOCATION PLAN
37 WILDPINE COURT, OTTAWA, ON

SCALE 1:750

SKETCH NO FIG 2

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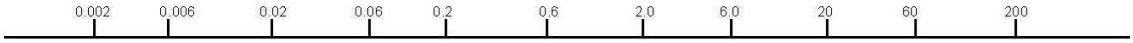
Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH-2

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 3

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~150 mm thick	115.7	0				
		FILL Silty sand with gravel (SM), organic, cobbles and boulders, some pieces of wood, brown, moist, (loose to compact)	115.6				BS1	
				1	10		SS2	
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist, (very loose)	114.2	2			SS3	
▽			113.3		3	89.4	SS4	
		SANDY SILT (ML) Grey, wet, (compact)	112.3	3		154.9	SS5	
				4	25, 15		SS6	
				5	20		SS7	
		GLACIAL TILL Silty sand with gravel (SM), brown to grey, wet	110.6					
		Borehole Terminated at 5.2 m Depth	110.5					

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe installed upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	3.4	
Jan. 5, 2021	2.4	
May 7, 2021	2.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-3

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 4

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	Symbol	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Samples	Natural Unit Wt. kN/m³
		ASPHALT ~60 mm thick	116.58	0				
		GRANULAR FILL Silty sand with gravel, grey, dry	116.5				BS1	
			116.0					
		FILL Silty sand with gravel, cobbles and boulders, grey, moist, (compact to very dense)		1	37		SS2	
					23		SS3	
		with organics from 2.3 m to 2.9 m depths		2	70		SS4	
▼			113.88					
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist, (loose)	113.6	3	7	174.1	SS5	
				4	8		SS6	
		SANDY SILT (ML) Grey, wet, (compact)	112.5					
				5	16		SS7	
			111.4					
		Borehole Terminated at 5.2 m Depth						

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	2.7	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit TP-1A

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 4A

Page. 1 of 1

Date Drilled: 'May 5, 2021

Drill Type: 'Excavator

Datum: Approximate Elevation

Logged by: A. Nader Checked by: I. Taki

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth
		TOPSOIL ~100 mm thick	116.07	0
		FILL Silty sand with gravel (SM), topsoil, wood chips, concrete pieces, foam insulation, asphalt pieces, tree roots and logs, brown, moist	116.0	1
			113.8	2
▼		**ORGANIC SILTY SAND TO SANDY SILT (SM TO ML)** Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	113.6	
		Test Pit Terminated at 2.5 m Depth	113.57	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60
SAMPLES
Natural Unit Wt. kN/m³

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	2.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN_ADDITIONAL TESTPITS FOR PERCOLATION.GPJ TROW OTTAWA.GDT 5/7/21

Log of Borehole BH-4

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 5

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty sand with gravel (SM), grey to brown, cobbles and boulders, damp to moist (dense to very dense)	116.72	0			BS1	
				1	37		SS2	
					88 for 250 mm		SS3	
		GLACIAL TILL Silty sand with gravel (SM), cobbles and boulders, grey, moist to wet, (very dense)	114.7	2				
					85 for 275 mm		SS4	
			114.02	3			RUN1	
				4				
		Borehole Terminated at 4.2 m Depth	112.5					

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe installed upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Jan. 5, 2021	2.7	
May 7, 2021	2.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

Log of Test Pit TP-4B

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 5A

Page. 1 of 1

Date Drilled: 'May 5, 2021

Drill Type: 'Excavator

Datum: Approximate Elevation

Logged by: A. Nader Checked by: I. Taki

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty sand with gravel (SM), grey to brown, cobbles and boulders, damp to moist	116.72	0	20 40 60 80 50 100 150 200	250 500 750 20 40 60		
			115.6	1				
		Test Pit Terminated at 1.1 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN_ADDITIONAL TESTPITS FOR PERCOLATION.GPJ TROW OTTAWA.GDT 5/7/21

Log of Borehole BH-6

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 6

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~150 mm thick	116.19	0				
		FILL Silty sand with gravel (SM), organic, cobbles and boulders, brown, moist, (loose)	116.0				BS1	
				1	5		SS2	
					6		SS3	
		GLACIAL TILL Silty sand with gravel (SM), cobbles and boulders, grey to brown, moist to wet, (compact to very dense)	114.2	2				
			113.89		23		SS4	
				3	29		SS5	
				4	22		SS6	
					83 for 225 mm		SS7	
			111.4					
		Borehole Terminated at 4.8 m Depth						

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe installed upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	2.4	
Jan. 5, 2021	2.3	
May 7, 2021	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-7

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 7

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	116.09	0				
		FILL Silty sand with gravel (SM), organic, pieces of wood and rootlets, (very loose to compact)	116.0				BS1	
				1	12		SS2	
				2	3		SS3	
					6		SS4	
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist, (loose)	113.3	3	6	240.5	SS5	
			112.7					
▼		**SANDY SILT (ML)** Grey, wet, (compact)	112.39	4	12		SS6	
				5	21		SS7	
		GLACIAL TILL Silty sand with gravel (SM), cobbles and boulders, brown, wet, (very dense)	110.3	6	76 for 225 mm		SS8	
		Auger Refusal at 6.4 m Depth	109.7					

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	3.7	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-8

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 8

Page. 1 of 1

Date Drilled: 'December 11, 2020

Drill Type: 'Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	115.79	0				
		FILL Silty sand with gravel (SM), organic, cobbles and boulders, pieces of wood, some topsoil, moist, (loose to compact)	115.7		16		BS1	
				1	10		SS2	
					7		SS3	
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist, (very loose)	113.8	2				
▽			112.99		1	165.1	SS4	
				3	3	146.7	SS5	
		SANDY SILT (ML) Grey, wet, (compact)	112.3					
				4	10		SS6	
					21		SS7	
				5				
		Auger Refusal at 5.9 m Depth	109.9					

LOG OF BOREHOLE ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/7/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe installed upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00263154-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	3.5	
Jan. 5, 2021	2.9	
May 7, 2021	2.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit TP-1

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 9

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	116.07	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		FILL Silty sand with gravel (SM), cobbles and boulders, topsoil, wood chips, concrete pieces, foam insulation, asphalt pieces, tree roots, brown, moist	116.0			334	BS1	
				1			BS2	
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	113.8	2				
			112.9	3			BS3	
▼		**SANDY SILT (ML)** Trace gravel, grey, moist to wet	112.1					
		Test Pit Terminated at 4.0 m Depth	112.07	4				

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-2

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 10

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—⊖
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm thick	115.67	0				
		FILL Silty sand with gravel (SM), organic, cobbles and boulders, concrete and asphalt pieces, tree roots, brown, moist	115.5				BS1	
				1				
							BS2	
				2				
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	113.4					
			112.7					
		SANDY SILT (ML) Trace to some gravel, grey, moist to wet		3			BS3	
			112.1					
		Test Pit Terminated at 3.6 m Depth						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-2A

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 10A

Page. 1 of 1

Date Drilled: 'May 5, 2021

Drill Type: 'Excavator

Datum: Approximate Elevation

Logged by: A. Nader Checked by: I. Taki

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth
		TOPSOIL ~200 mm thick	116.02	0
		FILL Silty sand with gravel (SM), cobbles and boulders, concrete, bricks, and asphalt pieces, brown to grey, moist to wet	115.8	
		SANDY SILT (ML) Some gravel, grey, moist to wet	114.1 114.0	2
		Test Pit Terminated at 2.0 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60
SAMPLES
Natural Unit Wt. kN/m³

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN_ADDITIONAL TESTPITS FOR PERCOLATION.GPJ TROW OTTAWA.GDT 5/7/21

Log of Test Pit TP-3

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 11

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	117.88	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		117.8						
		FILL Silty sand with gravel (SM), cobbles and boulders, rootlets, brown, moist				×	BS1	
				1				
						×	BS2	
				2				
			115.5					
		Test Pit Terminated at 2.4 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-4

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 12

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~300 mm	116.5	0				
		FILL Silty sand with gravel (SM), concrete and asphalt pieces, cobbles and boulders, brown, moist	116.2			×	BS1	
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	115.0	1				
		GLACIAL TILL Silty sand with gravel (SM), cobbles and boulders, grey, moist	114.5	2		×	BS2	
		Test Pit Terminated at 3.0 m Depth	113.5	3				

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-4C

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 12A

Page. 1 of 1

Date Drilled: 'May 5, 2021

Drill Type: 'Excavator

Datum: Approximate Elevation

Logged by: A. Nader Checked by: I. Taki

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢—⊖
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~300 mm	116.5	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		FILL Silty sand with gravel (SM), concrete and asphalt pieces, cobbles and boulders, brown, moist	116.2					
			115.4	1				
		Test Pit Terminated at 1.1 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN_ADDITIONAL TESTPITS FOR PERCOLATION.GPJ TROW OTTAWA.GDT 5/7/21

Log of Test Pit TP-5

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 13

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			117.58	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		TOPSOIL ~125 mm thick	117.5					
		FILL Silty sand with gravel (SM), cobbles and boulders, grey, moist				×	BS1	
			116.7	1				
		GLACIAL TILL Silty sand with gravel (SM), occasional cobbles and boulders, grey, moist				×	BS2	
			115.2	2				
		Test Pit Terminated at 2.4 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-6

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 14

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	115.86	0				
		FILL Silty sand with gravel (SM), organic, cobbles and boulders, concrete, wood, and asphalt pieces, tree roots, brown and black, moist to wet	115.7				BS1	
				1			BS2	
			113.5					
▼		**ORGANIC SILTY SAND TO SANDY SILT (SM TO ML)** Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	113.16	2				
			112.6	3			BS3	
		SANDY SILT (ML) Trace gravel, grey, moist to wet	111.9					
		Test Pit Terminated at 4.0 m Depth		4				

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	2.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-7

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 15

Page. 1 of 1

Date Drilled: 'December 18, 2020

Drill Type: 'Excavator

Datum: Geodetic Elevation

Logged by: A. Neguss Checked by: A. Nader

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test ——— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty sand with gravel (SM), concrete, wood, and asphalt pieces, cobbles and boulders, roots, brown, moist	116.66	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
				1		×	BS1	
			115.1					
		ORGANIC SILTY SAND TO SANDY SILT (SM TO ML) Silty sand to sandy silt with pieces of decaying wood and topsoil, dark brown, moist to wet	114.8					
				2		×	BS2	
		GLACIAL TILL Silty sand with gravel (SM), cobbles and boulders, grey, moist	114.0					
		Test Pit Terminated at 2.7 m Depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN.GPJ TROW OTTAWA.GDT 5/6/21

Log of Test Pit TP-4A

Project No: OTT-00263154-A0

Project: Proposed Residential Development

Location: 37 Wildpine Court, Ottawa, Ontario

Figure No. 15A

Page. 1 of 1

Date Drilled: 'May 5, 2021

Drill Type: 'Excavator

Datum: Approximate Elevation

Logged by: A. Nader Checked by: I. Taki

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Elevation m	Depth
		TOPSOIL ~150 mm thick	116.35	0
		FILL Silty sand with gravel (SM), cobbles and boulders, brown, damp to moist	116.2	
		with organics from 1.1 m to 1.3 m depths		1
			114.4	2
▼		**GLACIAL TILL** Silty sand with gravel (SM), cobbles and boulders, grey, moist to wet	113.85	
		Test Pit Terminated at 2.5 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60
SAMPLES
Natural Unit Wt. kN/m³

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Test Pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00263154-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	2.5	

CORE DRILLING RECORD

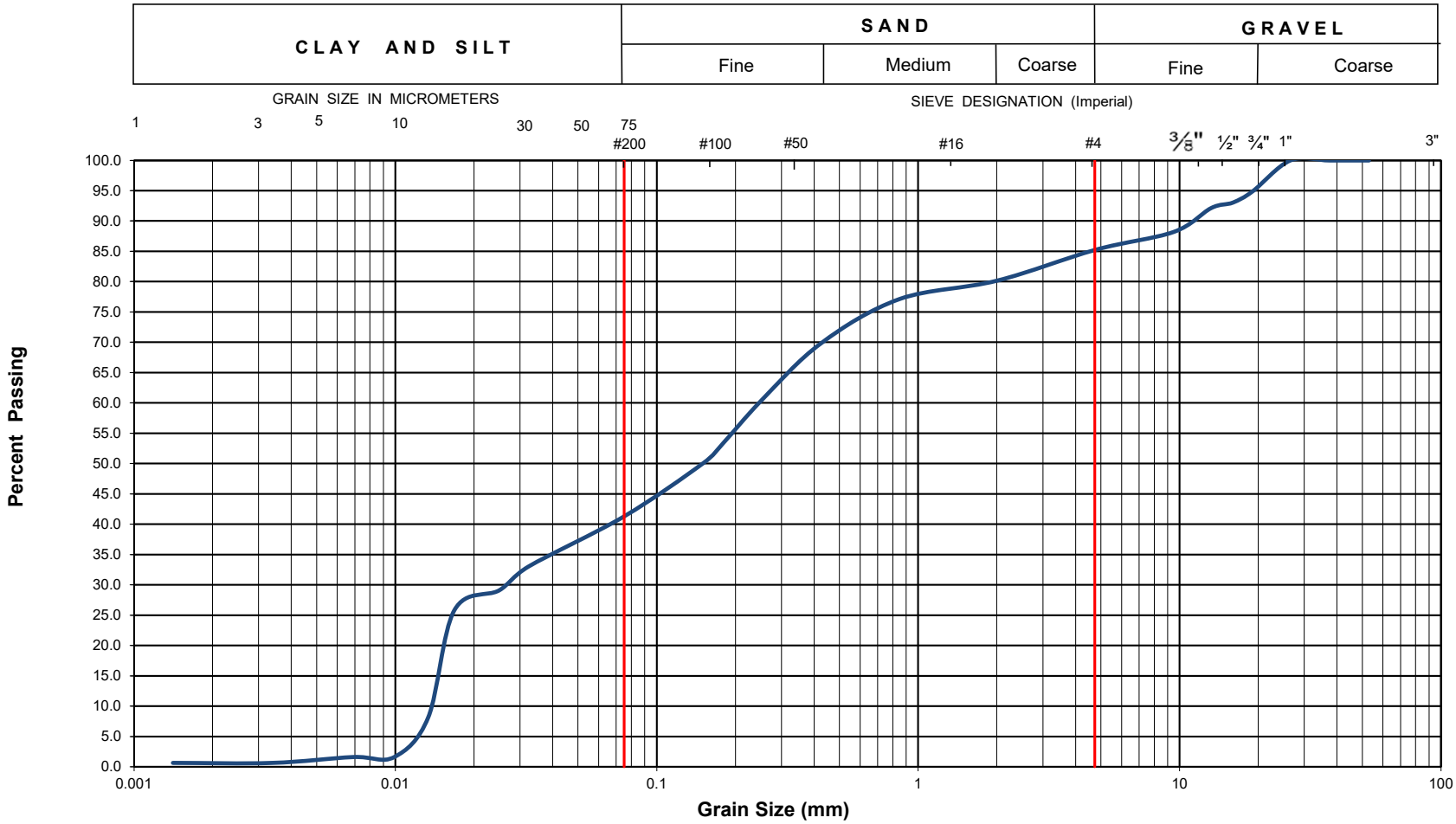
Run No.	Depth (m)	% Rec.	RQD %

LOG OF TEST PIT ALL TESTHOLE LOGS - 263154_AN_ADDITIONAL TESTPITS FOR PERCOLATION.GPJ TROW OTTAWA.GDT 5/7/21

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-2**		**Sample No.:**	**SS2**		**Depth (m) :**	**0.8-1.4**
Sample Description :		**% Silt and Clay**	**42**	**% Sand**	**43**	**% Gravel**	**15**	**Figure :**	**16**
Sample Description :		**FILL: Silty SAND with Gravel (SM)**							

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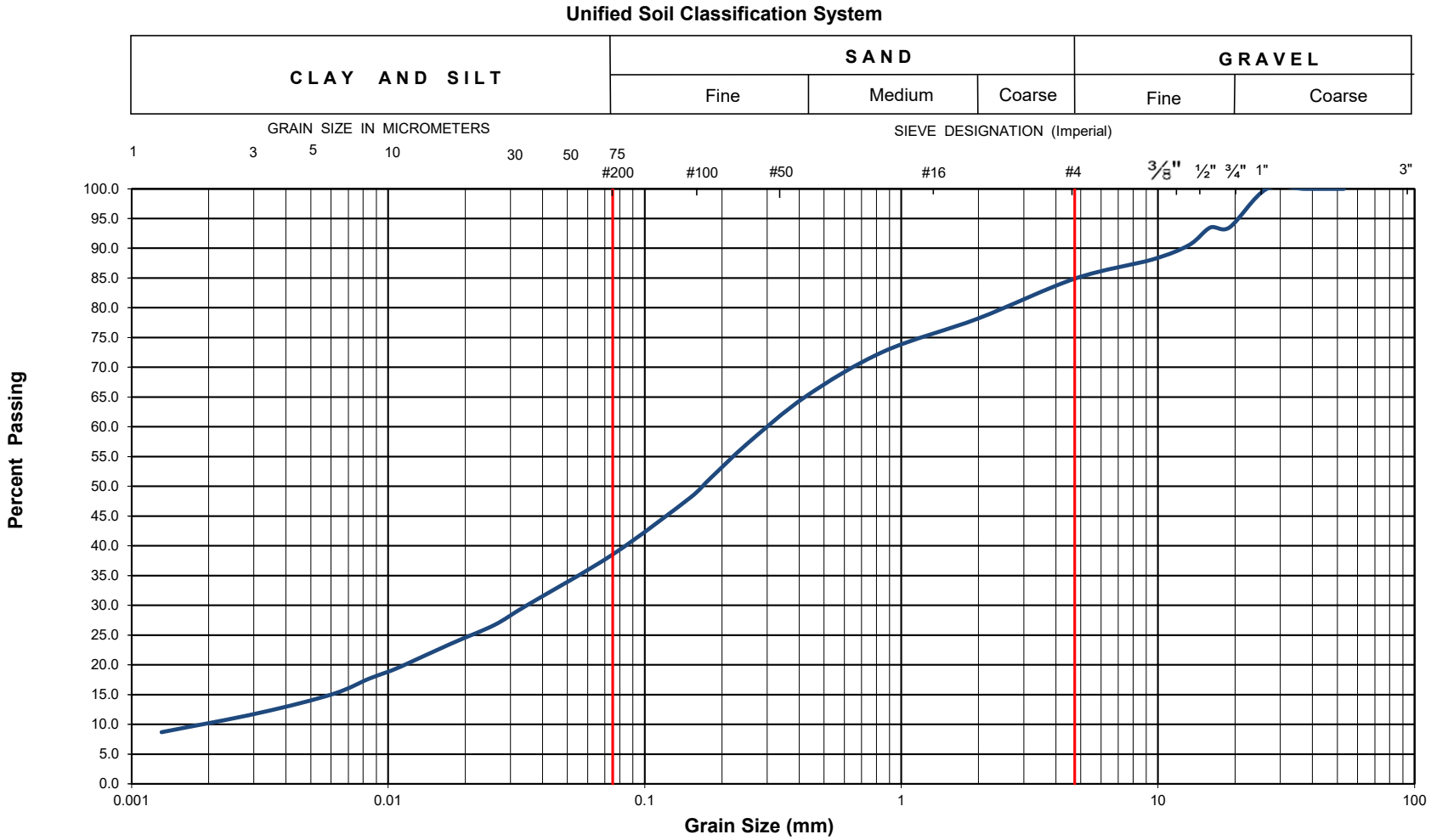
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-7**		**Sample No.:**	**SS2**		**Depth (m) :**	**0.8-1.4**
Sample Description :		**% Silt and Clay**	**39**	**% Sand**	**46**	**% Gravel**	**15**	**Figure :**	**17**
Sample Description :		**FILL: Silty Sand with Gravel (SM)**							

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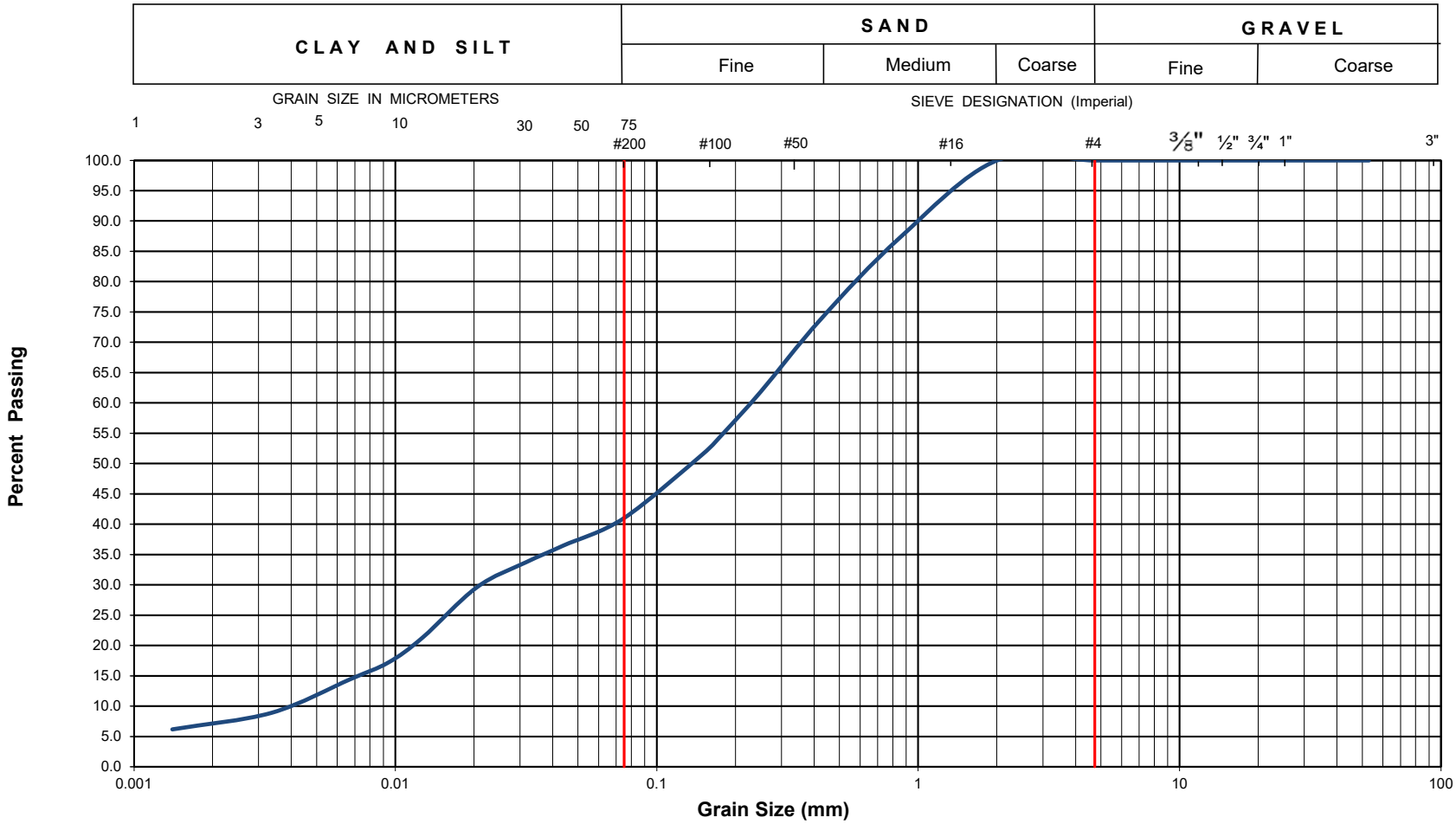
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-2**		**Sample No.:**	**SS4**		**Depth (m) :**	**2.3-2.9**
Sample Description :		**% Silt and Clay**	**41**	**% Sand**	**59**	**% Gravel**	**0**	**Figure :**	**18**
Sample Description :		**Organic Silty SAND (SM)**							

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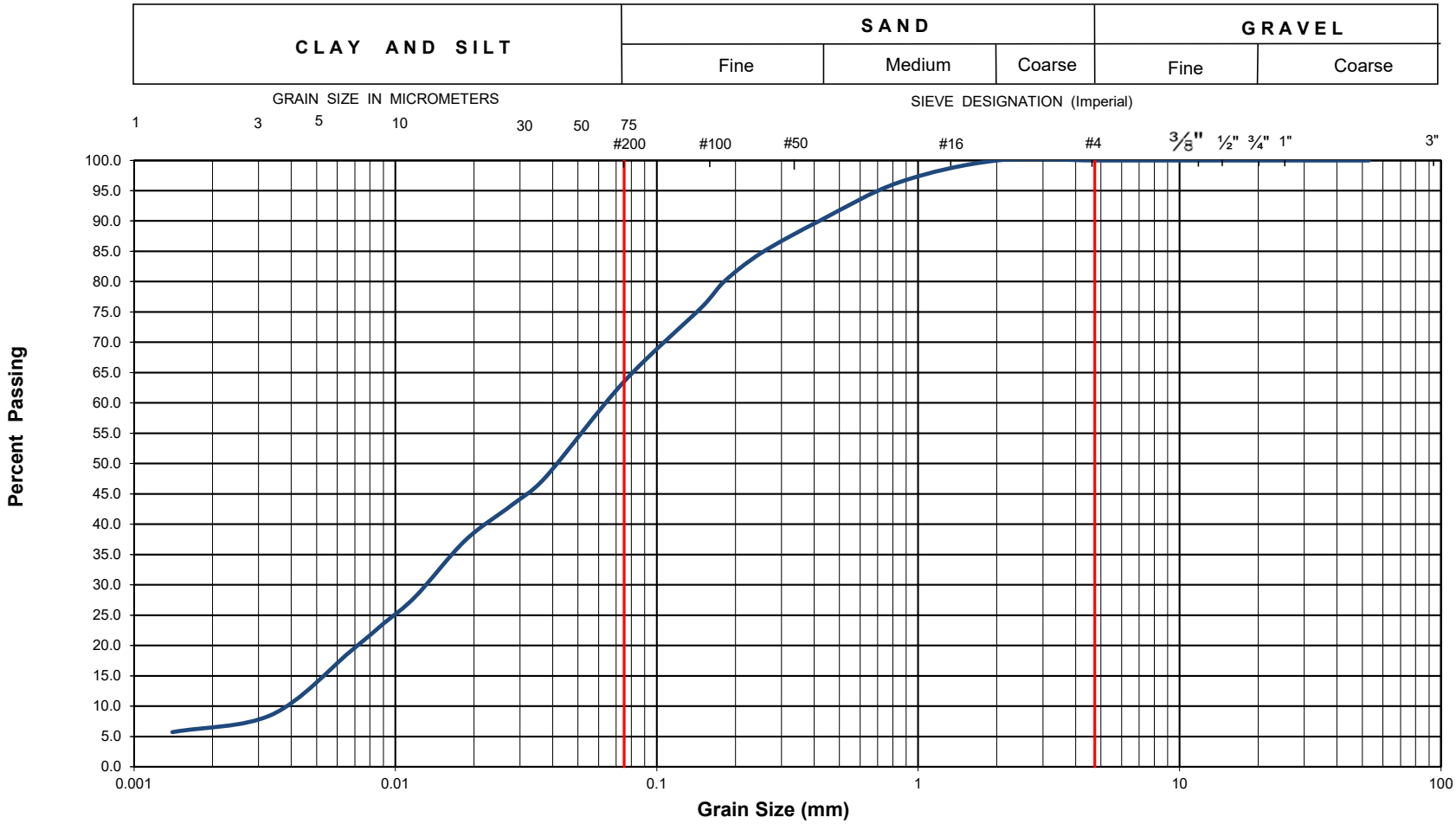
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-3**		**Sample No.:**	**SS5**		**Depth (m) :**	**3.0-3.7**
Sample Description :		**% Silt and Clay**	**64**	**% Sand**	**36**	**% Gravel**	**0**	**Figure :**	**19**
Sample Description :		**Organic Sandy SILT (ML)**							

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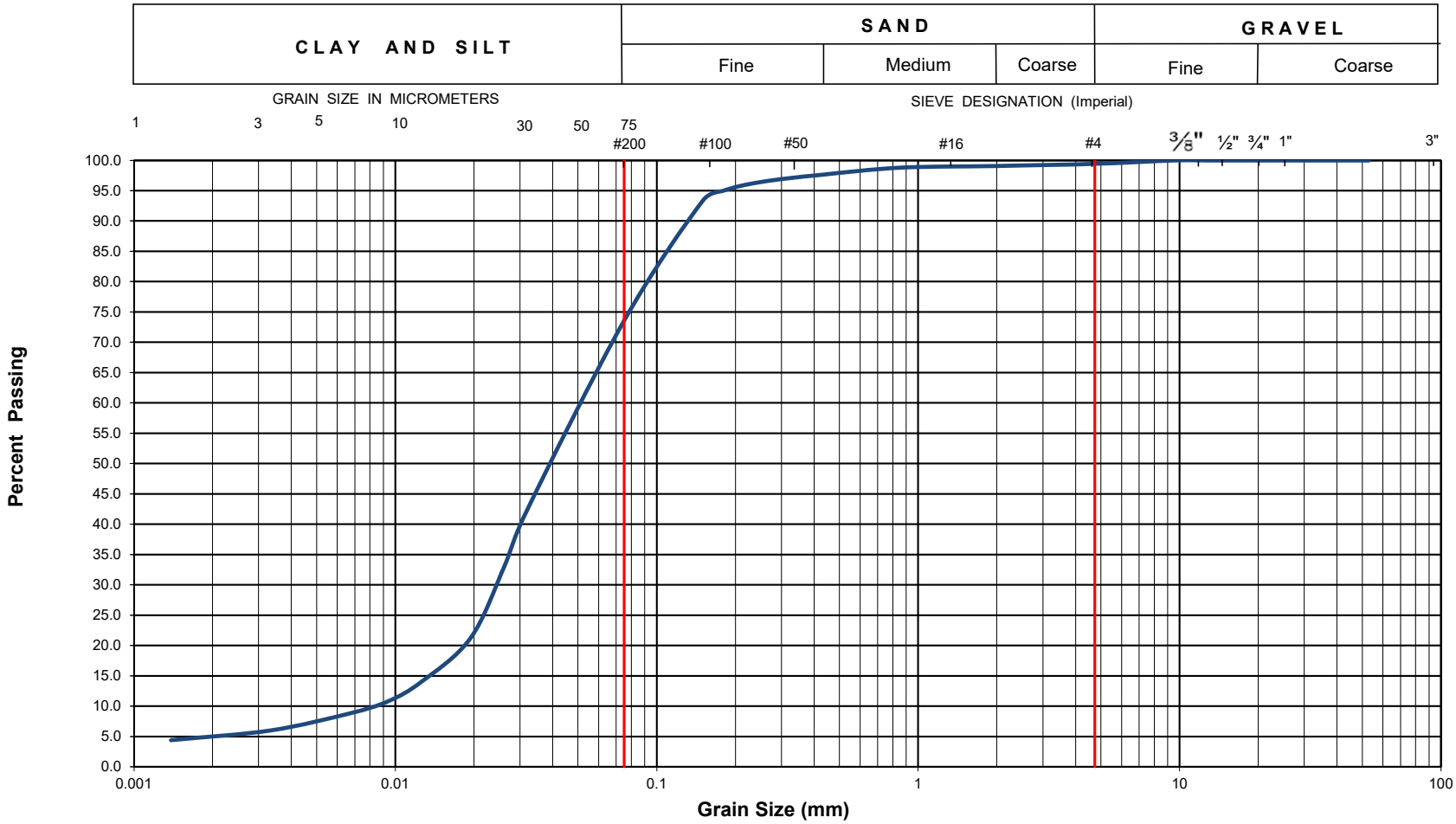
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-3**		**Sample No.:**	**SS7**		**Depth (m) :**	**4.6-5.2**
Sample Description :		**% Silt and Clay**	**73**	**% Sand**	**26**	**% Gravel**	**1**	**Figure :**	**20**
Sample Description :		**Sandy SILT (ML)**							

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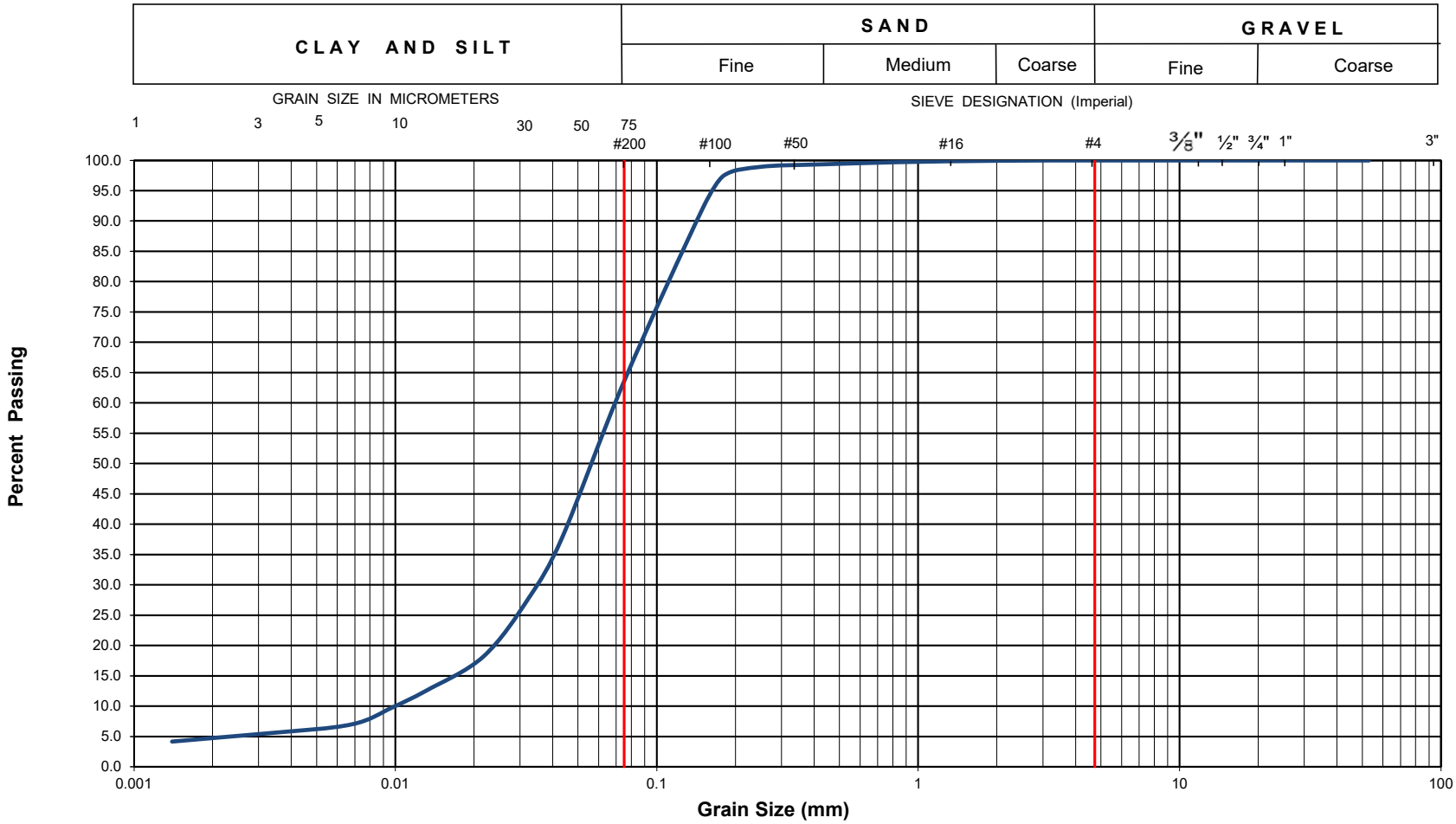
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-8**		**Sample No.:**	**SS6**		**Depth (m) :**	**3.8-4.4**
Sample Description :		**% Silt and Clay**	**64**	**% Sand**	**36**	**% Gravel**	**0**	**Figure :**	**21**
Sample Description :		**Sandy Silt (ML)**							

EXP Services Inc.
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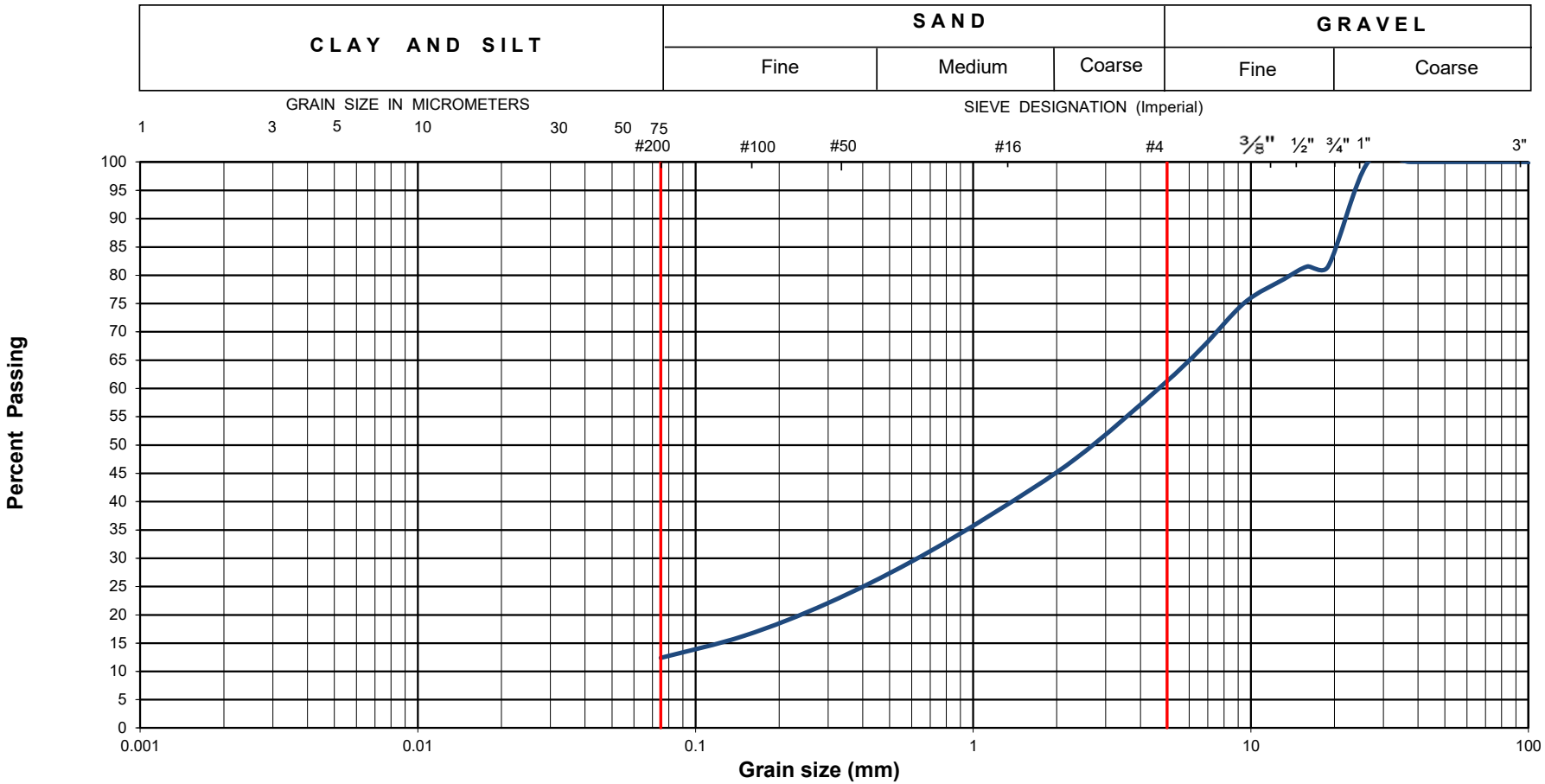
Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System

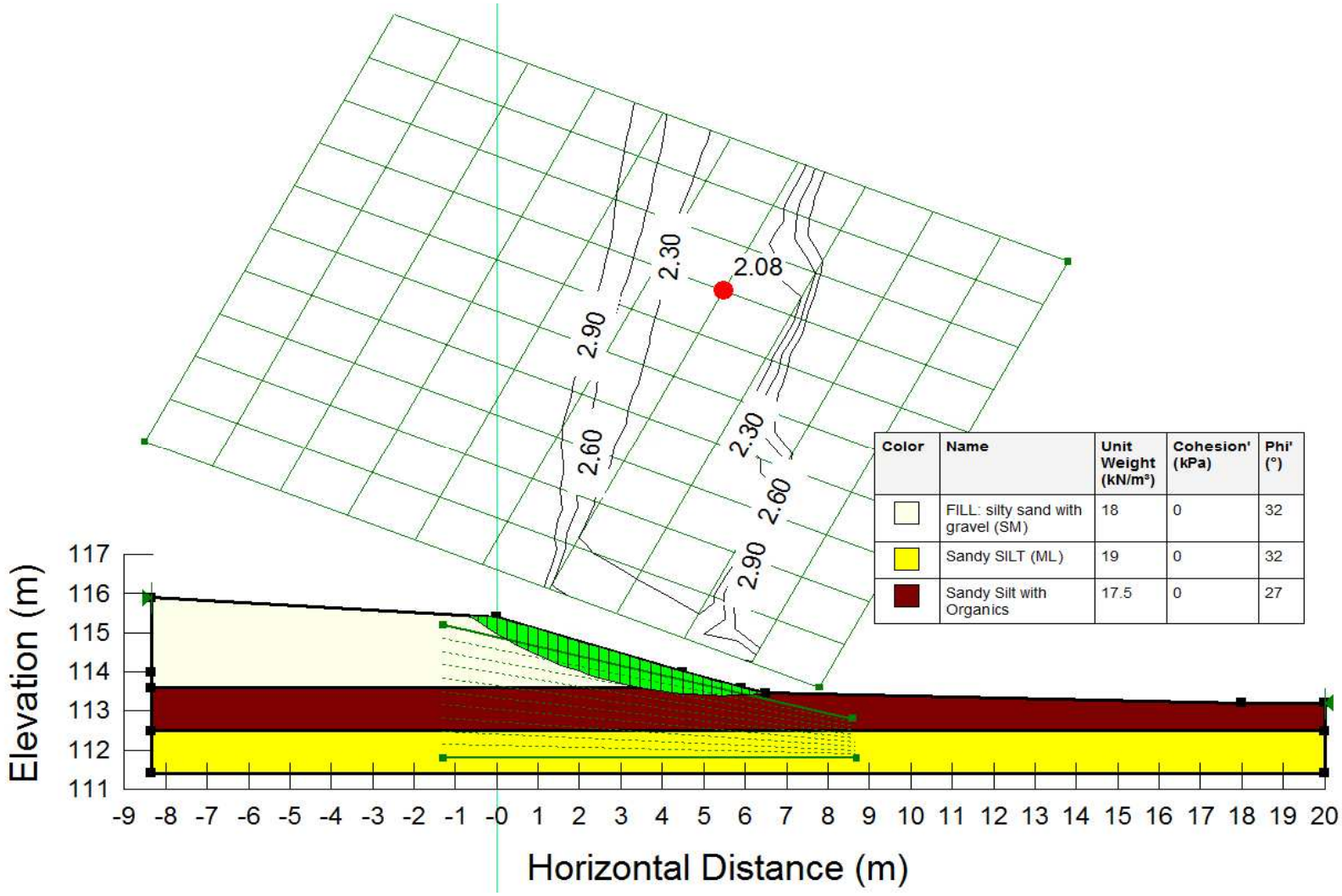


EXP Project No.:	**OTT-00263154-A0**	**Project Name :**	**Proposed Residential Development**						
Client :	**Wildpine Trails Inc.**	**Project Location :**	**37 Wildpine Court, Ottawa, Ontario**						
Date Sampled :	**December 11, 2020**	**Borehole No:**	**BH-4**	**Sample:**	**SS3**	**Depth (m) :**	**1.5-2.1**		
Sample Composition :		**Gravel (%)**	**39**	**Sand (%)**	**48**	**Silt & Clay (%)**	**13**	**Figure :**	**22**
Sample Description :		**GLACIAL TILL: Silty Sand with Gravel (SM)**							

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 23a

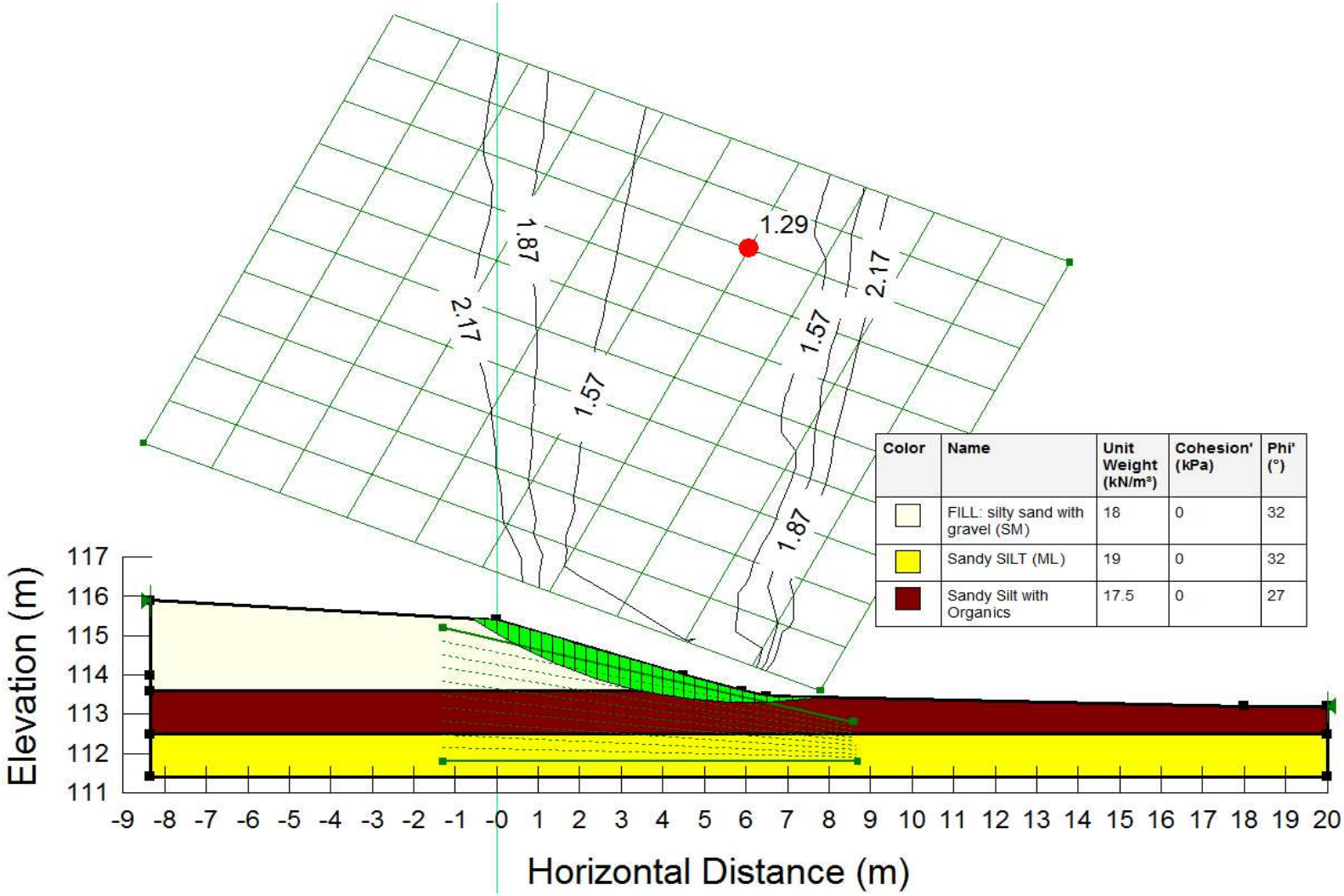


Condition : Total Stresses
Analysis Method : Morgenstern-Price
Cross-section : A

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 23b

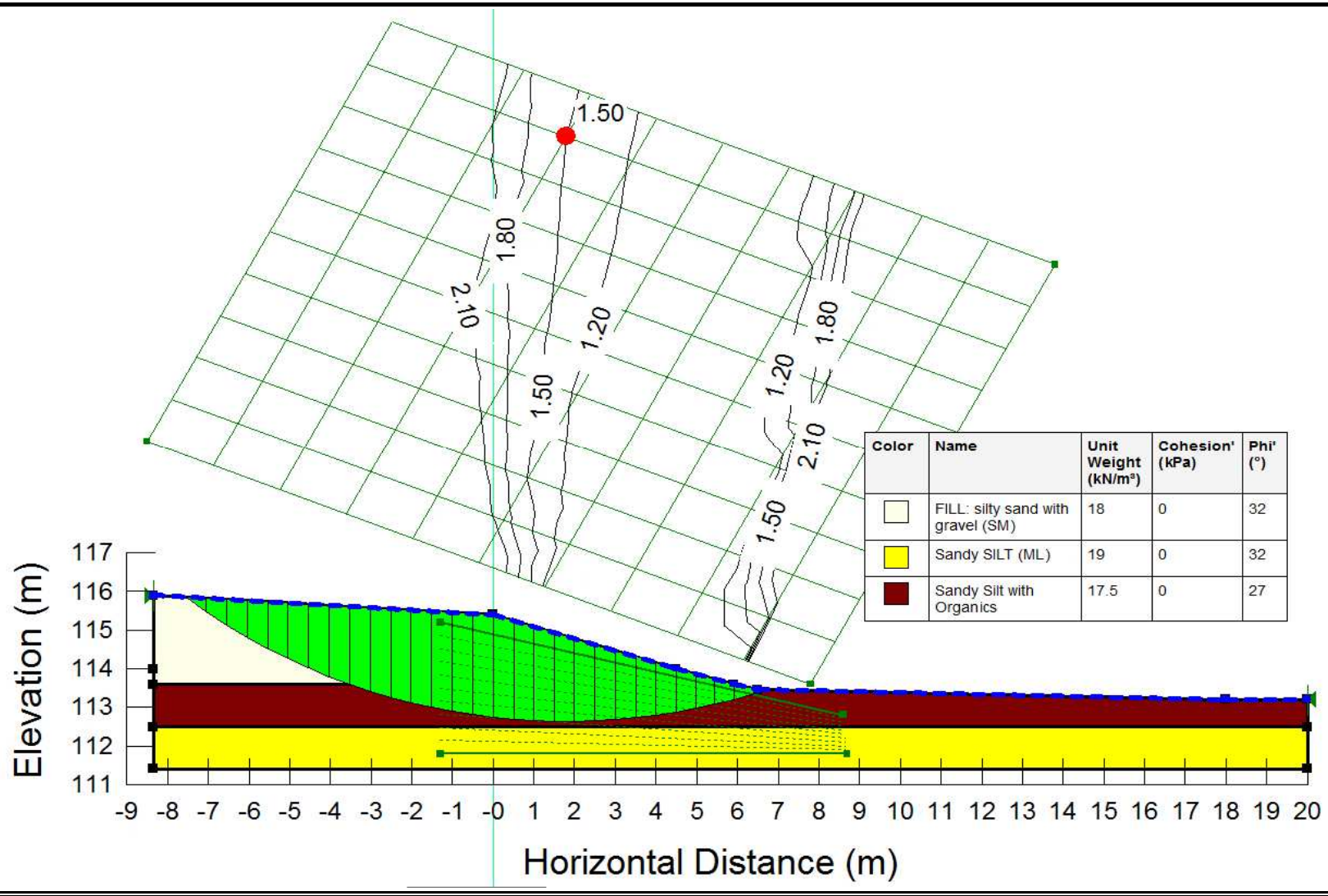


Condition : Total Stresses/Siesmic Loading
Analysis Method : Morgenstern-Price
Cross-section : A

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 23c

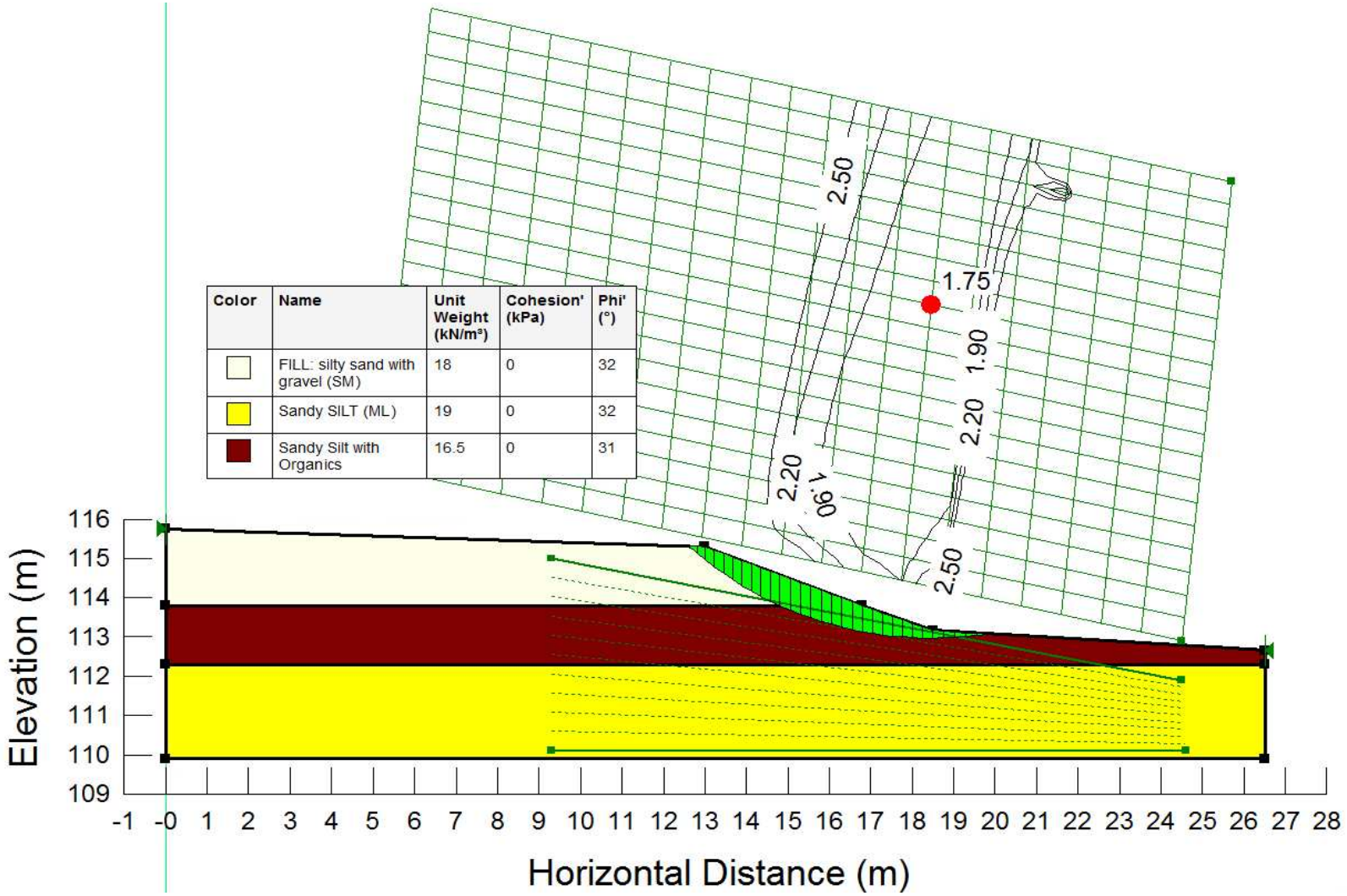


Condition : Effective Stresses/Saturated Slope
Analysis Method : Morgenstern-Price
Cross-section : A

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 24a

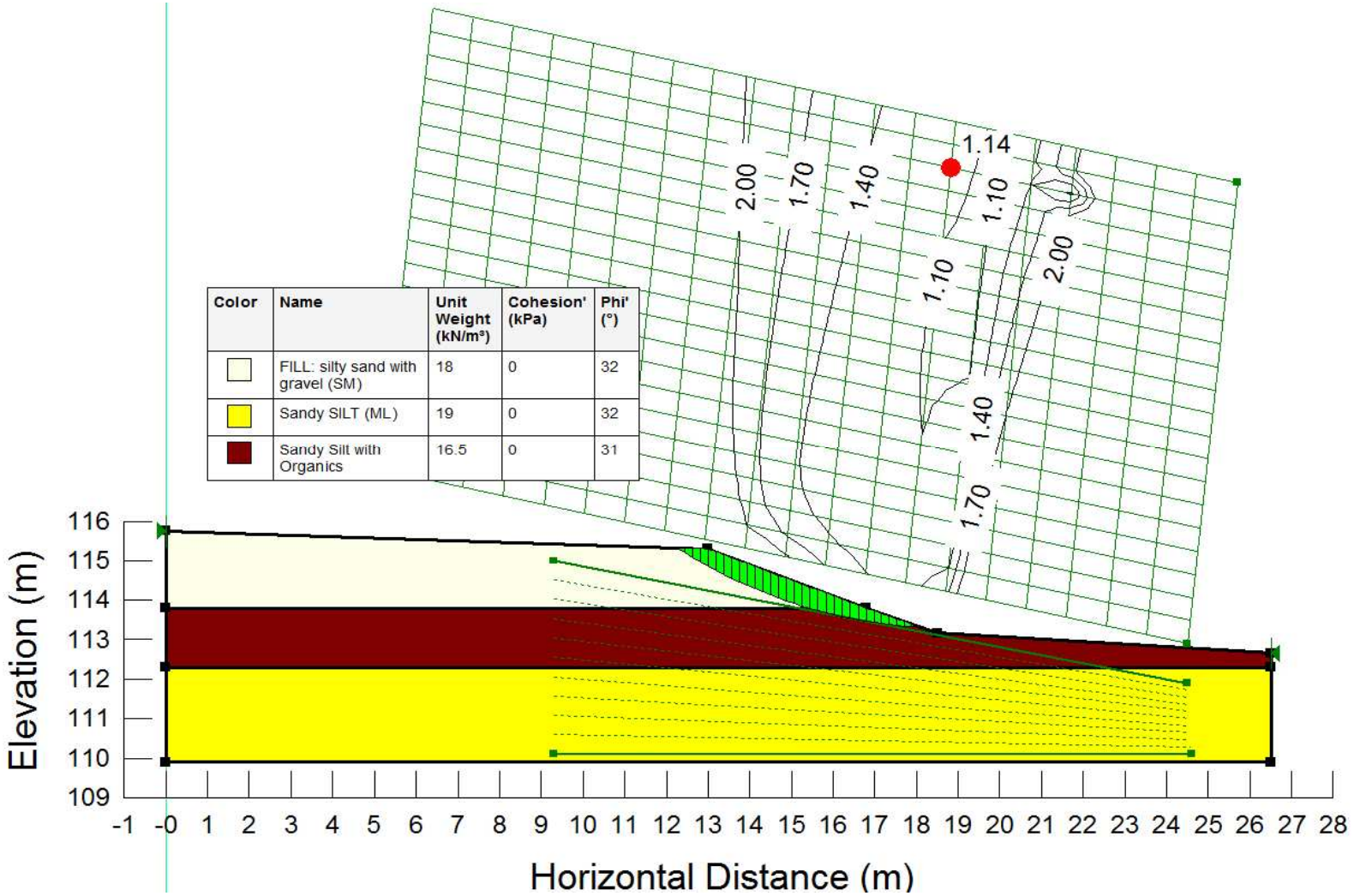


Condition	:	Total Stresses
Analysis Method	:	Morgenstern-Price
Cross-section	:	B

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 24b

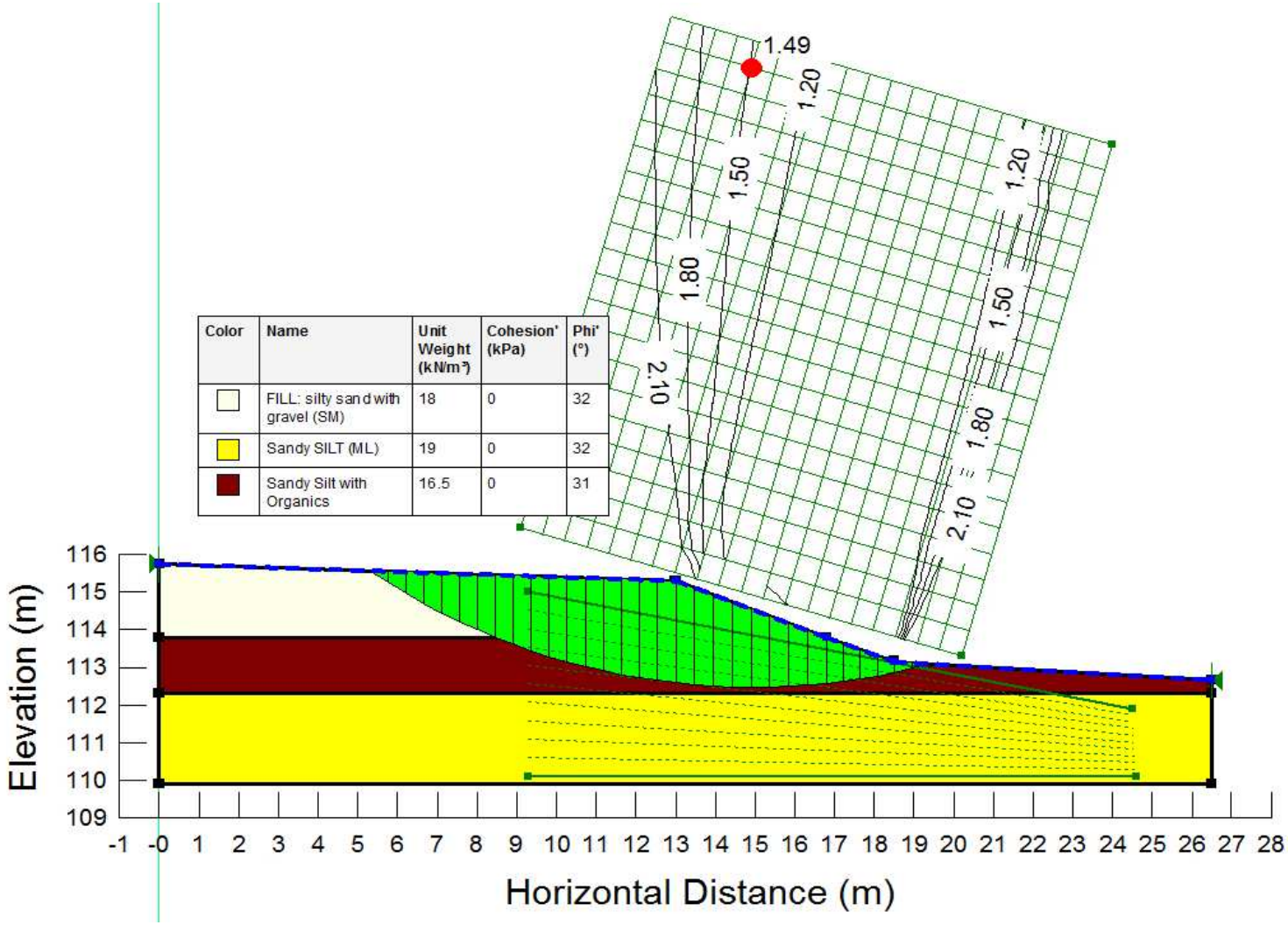


Condition	:	Total Stresses/Siesmic Loading
Analysis Method	:	Morgenstern-Price
Cross-section	:	B

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 24c

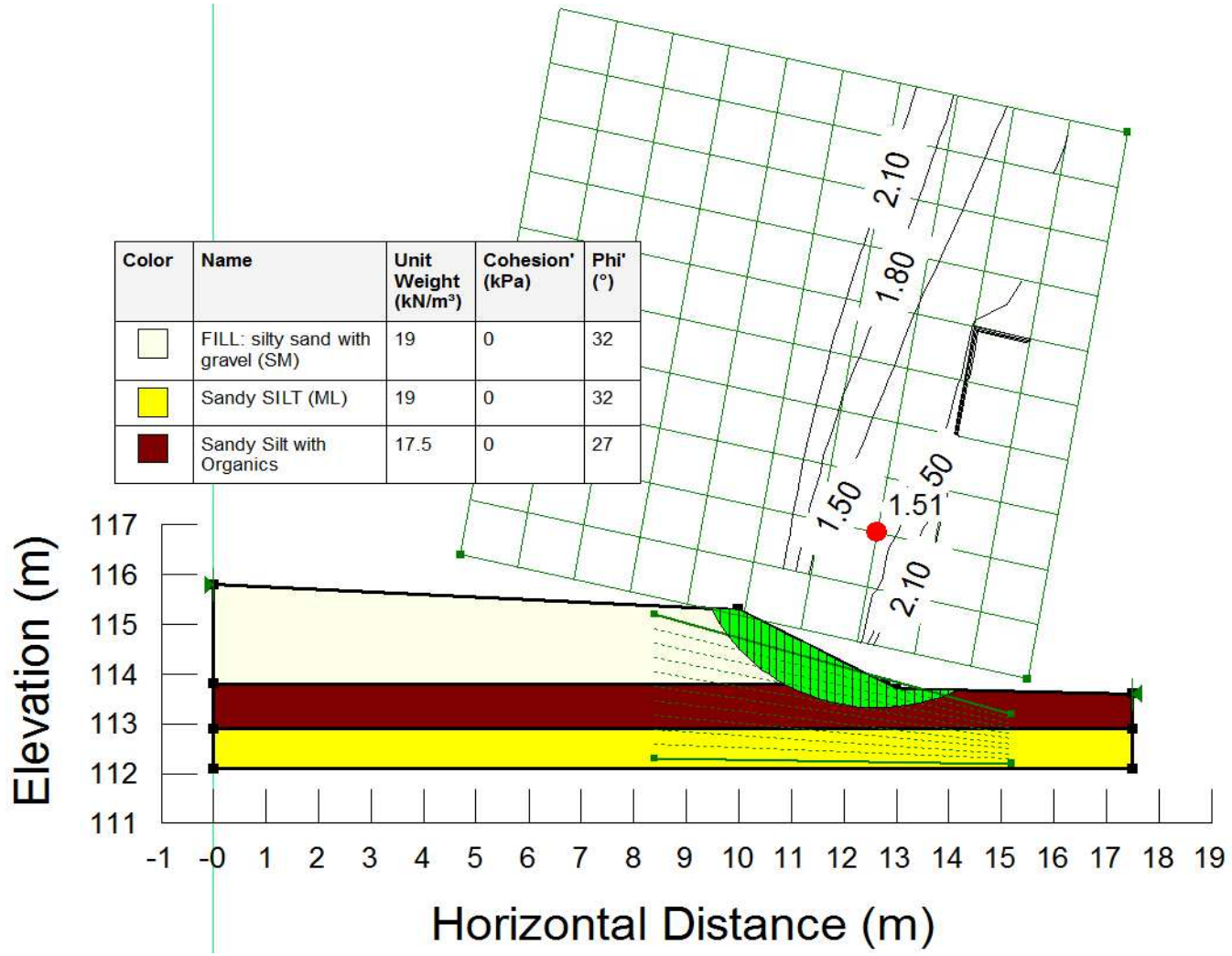


Condition : Effective Stresses/Saturated Slope
Analysis Method : Morgenstern-Price
Cross-section : B

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 25a

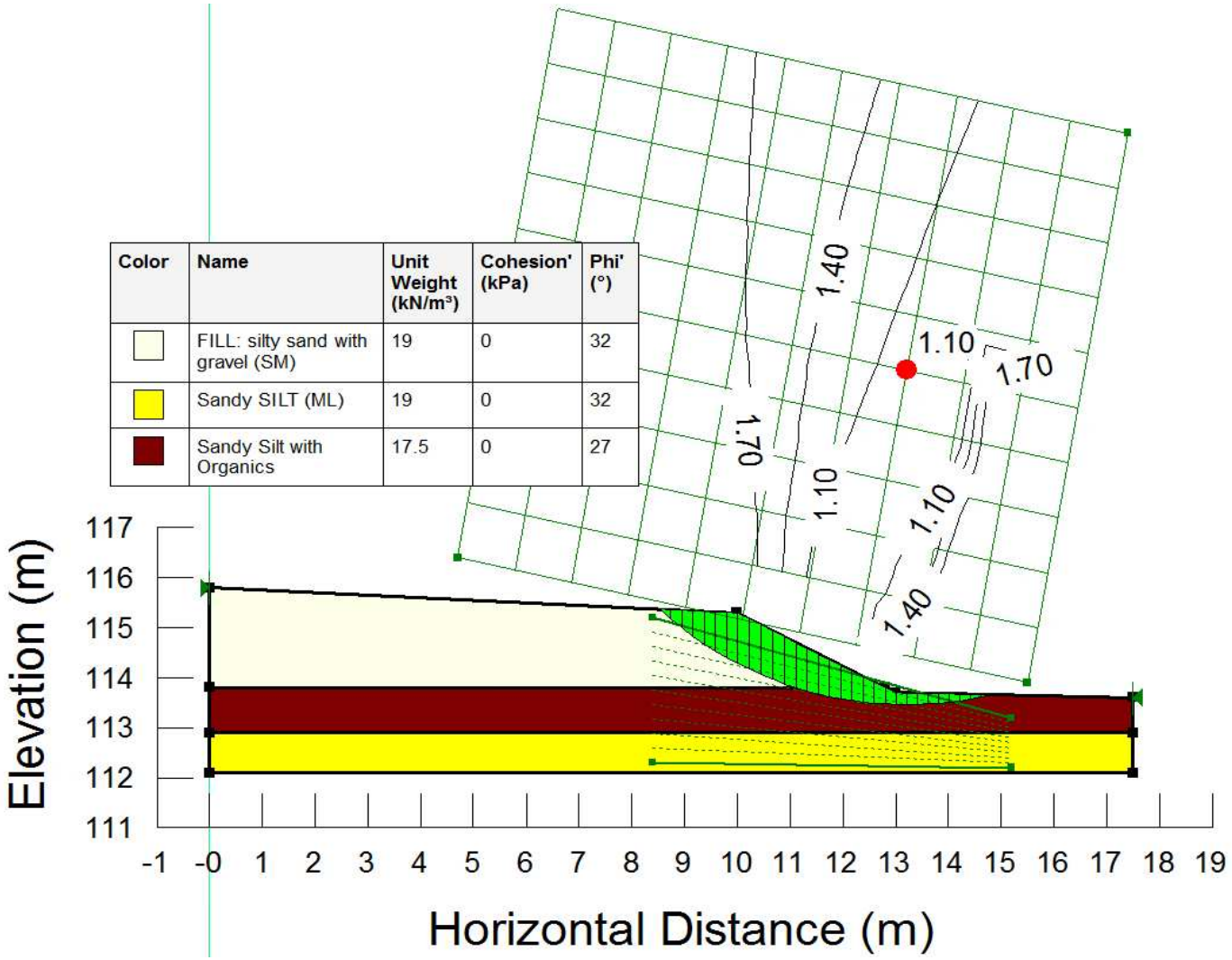


Condition : Total Stresses
Analysis Method : Morgenstern-Price
Cross-section : C

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 25b

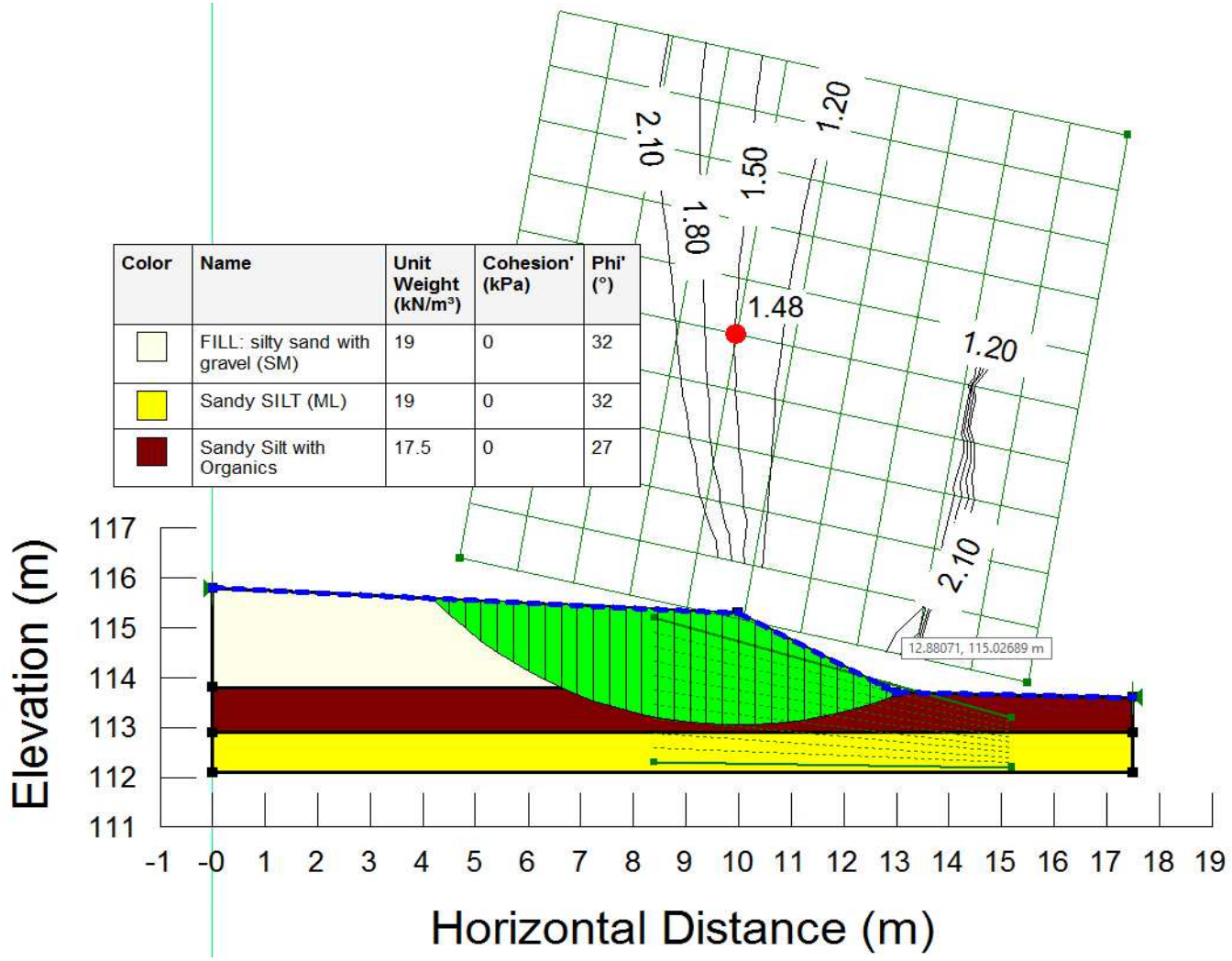


Condition : Total Stresses/Siesmic Loading
Analysis Method : Morgenstern-Price
Cross-section : C

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 25c

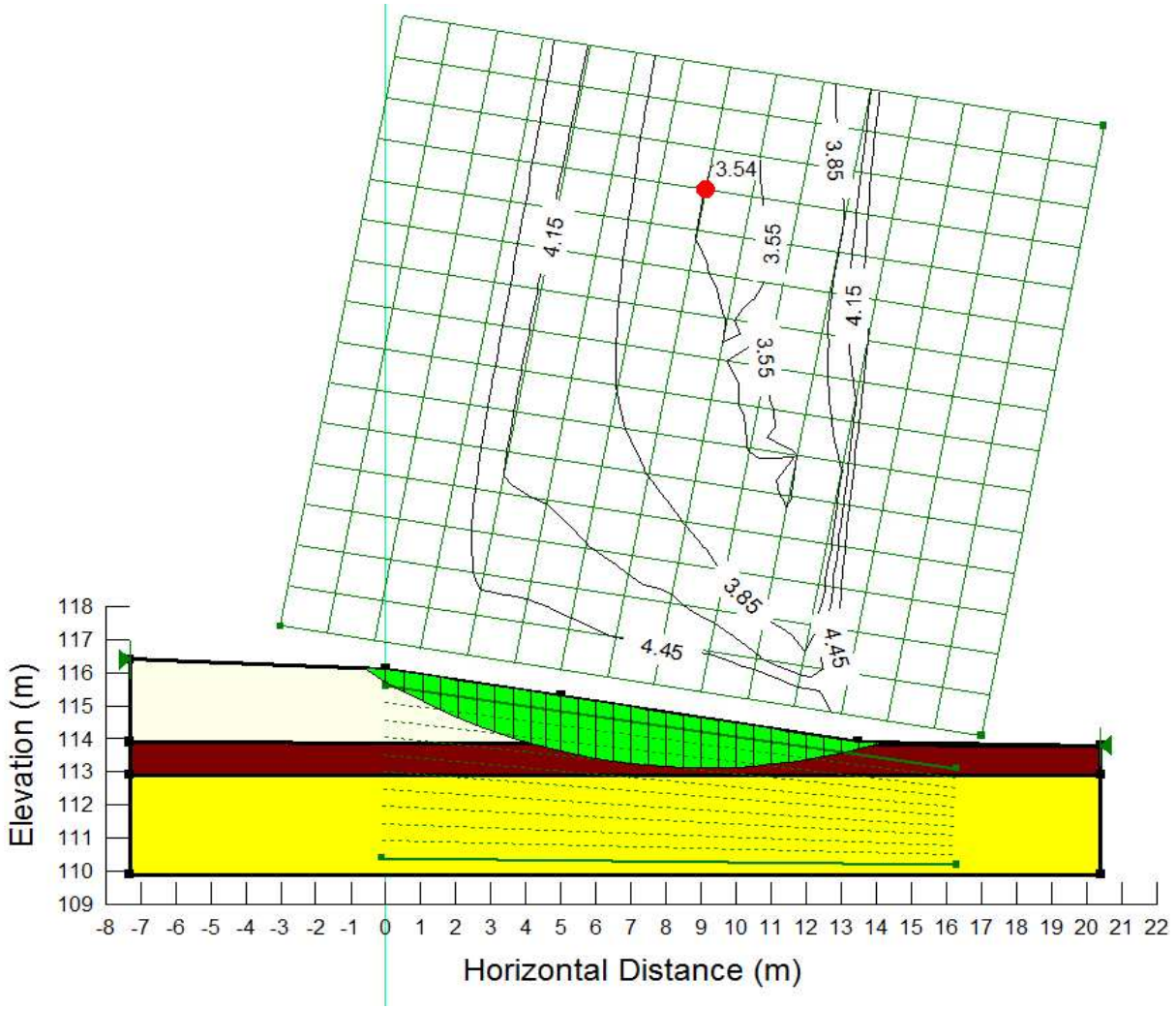


Condition	:	Effective Stresses/Saturated Slope
Analysis Method	:	Morgenstern-Price
Cross-section	:	C

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 26a

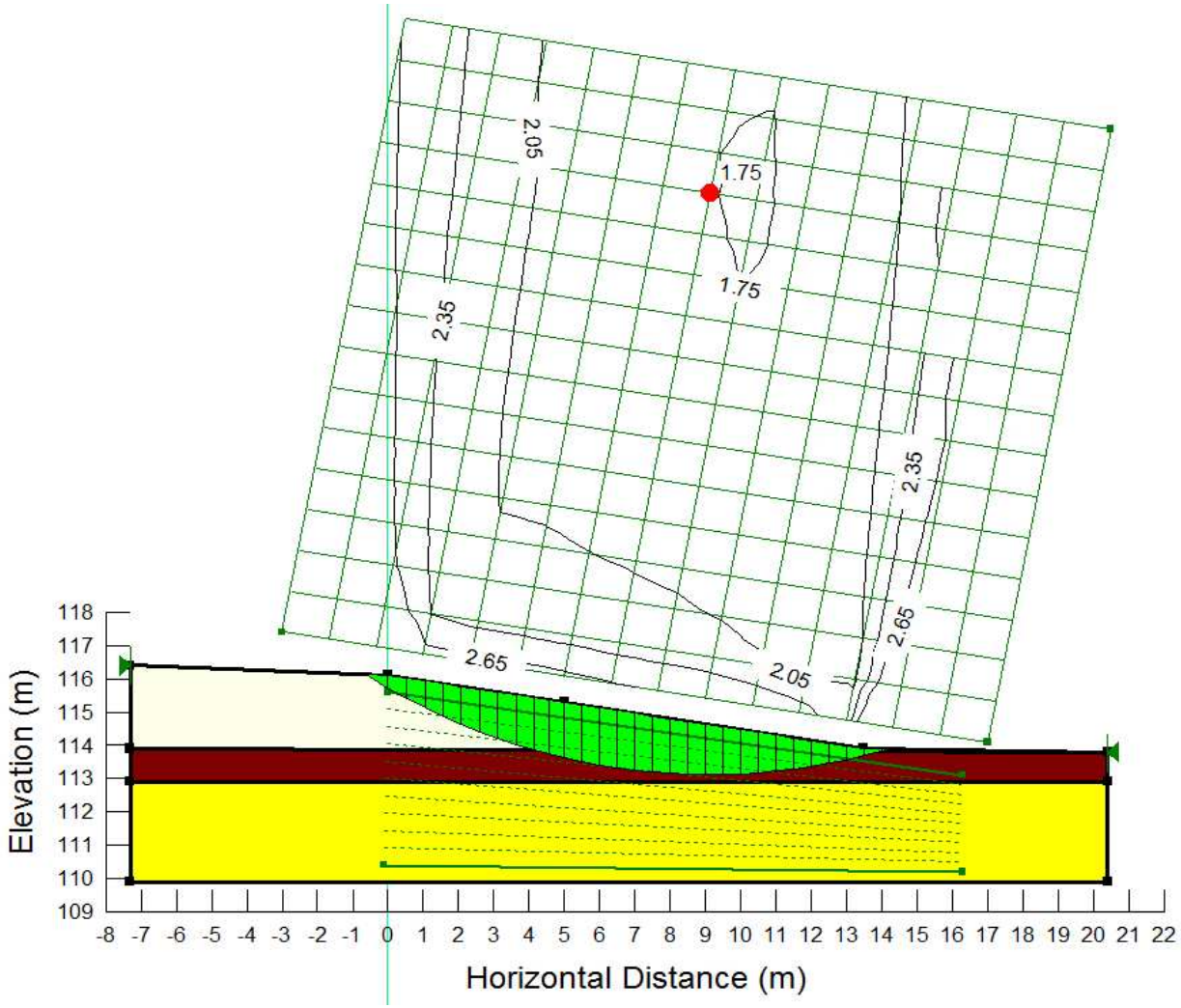


Condition	:	Total Stresses
Analysis Method	:	Morgenstern-Price
Cross-section	:	D

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 26b

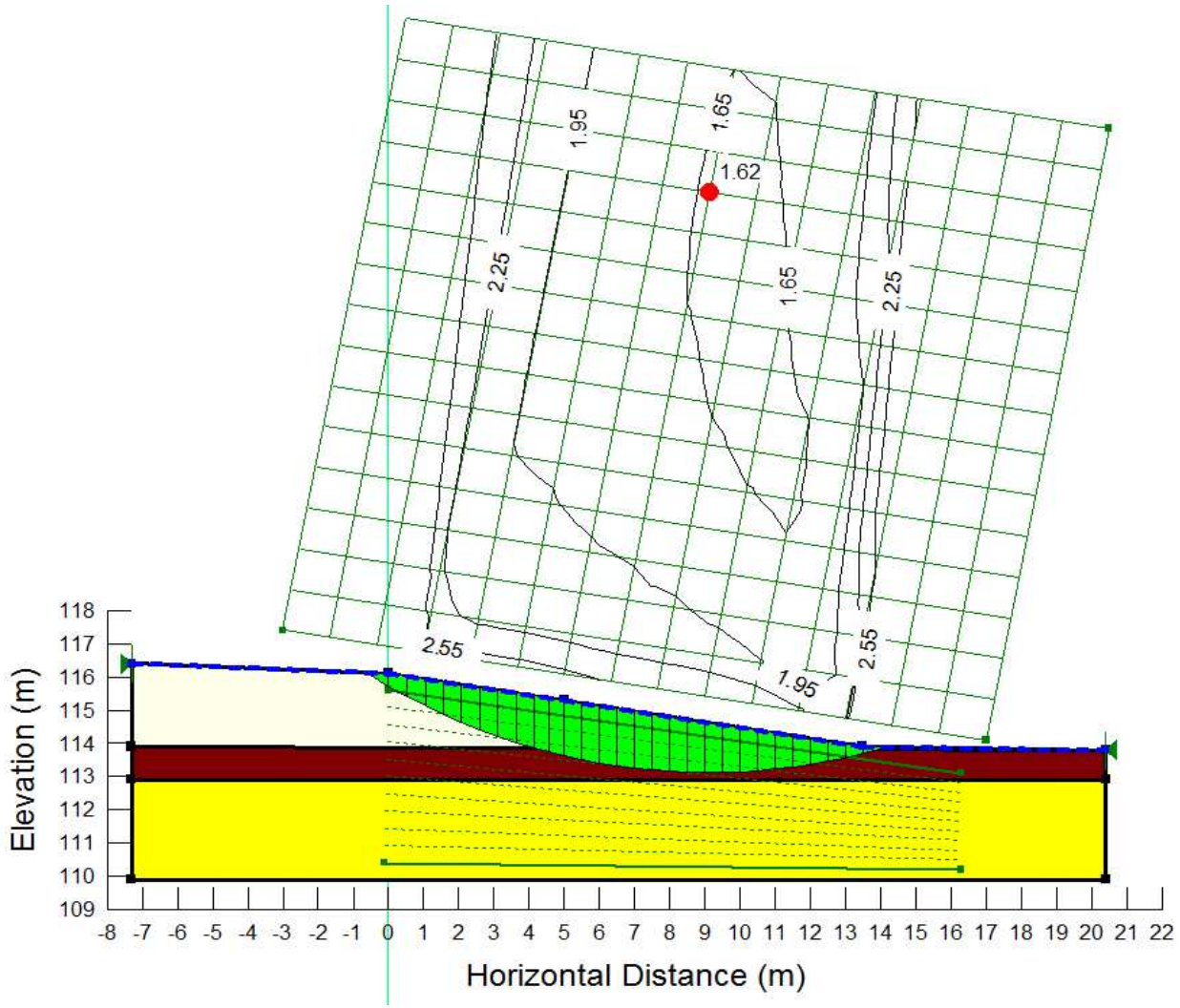


Condition	:	Total Stresses/Siesmic Loading
Analysis Method	:	Morgenstern-Price
Cross-section	:	D

SLOPE STABILITY ANALYSIS
Proposed Residential Development
37 Wildpine Court, Ottawa, Ontario

OTT-00263154-A0

Figure No. 26c



Condition	:	Effective Stresses/Saturated Slope
Analysis Method	:	Morgenstern-Price
Cross-section	:	D

Appendix A:
Laboratory Certificate of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **EXP SERVICES INC**
2650 QUEENSVIEW DRIVE, UNIT 100
OTTAWA, ON K2B8H6
(613) 688-1899

ATTENTION TO: **Maxime Leroux**

PROJECT: **OTT-263154**

AGAT WORK ORDER: **21Z696412**

SOIL ANALYSIS REVIEWED BY: **Amanjot Bhela, Inorganic Lab Manager**

DATE REPORTED: **Jan 13, 2021**

PAGES (INCLUDING COVER): **6**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days following analysis, unless expressly agreed otherwise in writing. Please contact your Client Project Manager if you require additional sample storage time.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21Z696412

PROJECT: OTT-263154

CLIENT NAME: EXP SERVICES INC

SAMPLING SITE:37 Wildpine

ATTENTION TO: Maxime Leroux

SAMPLED BY:EXP

Inorganic Chemistry (Soil)

DATE RECEIVED: 2021-01-05 **DATE REPORTED: 2021-01-13**

		SAMPLE DESCRIPTION:		BH4 SS4 7. 5'-9.5'	BH4 SS4 10'-12'
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2020-12-11	2020-12-11
Parameter	Unit	G / S	RDL	1917733	1917735
Chloride (2:1)	µg/g		2	17	121
Sulphate (2:1)	µg/g		2	23	73
pH (2:1)	pH Units		NA	8.38	7.27
Resistivity (2:1) (Calculated)	ohm.cm		1	6370	2160

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1917733-1917735 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
AMANJOT BHELA
CHEMIST

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21Z696412

PROJECT: OTT-263154

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Maxime Leroux

SAMPLING SITE:37 Wildpine

SAMPLED BY:EXP

Inorganic Chemistry (Soil) (%)

DATE RECEIVED: 2021-01-05 **DATE REPORTED: 2021-01-13**

		SAMPLE DESCRIPTION:		BH4 SS4 7. 5'-9.5'	BH4 SS4 10'-12'
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2020-12-11	2020-12-11
Parameter	Unit	G / S	RDL	1917733	1917735
Chloride (2:1)	%		0.0002	0.0017	0.0121
Sulphate (2:1)	%		0.0002	0.0023	0.0073

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1917733-1917735 Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 21Z696412

PROJECT: OTT-263154

ATTENTION TO: Maxime Leroux

SAMPLING SITE:37 Wildpine

SAMPLED BY:EXP

Soil Analysis

RPT Date: Jan 13, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Soil)															
Chloride (2:1)	1917769		7	7	NA	< 2	101%	70%	130%	106%	80%	120%	107%	70%	130%
Sulphate (2:1)	1917769		57	56	1.8%	< 2	102%	70%	130%	103%	80%	120%	103%	70%	130%
pH (2:1)	1917744		7.81	7.84	0.4%	NA	99%	90%	110%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

Inorganic Chemistry (Soil) (%)															
Chloride (2:1)	1917769	0.0007	0.0007	NA	< 0.0002	101%	70%	130%	106%	80%	120%	107%	70%	130%
Sulphate (2:1)	1917769	0.0057	0.0056	1.8%	< 0.0002	102%	70%	130%	103%	80%	120%	103%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
AMANJOT BHELA
CHEMIST

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 21Z696412

PROJECT: OTT-263154

ATTENTION TO: Maxime Leroux

SAMPLING SITE:37 Wildpine

SAMPLED BY:EXP

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION

AGAT Laboratories

L.T → 8 2/8 3/8 4

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: EXP Services
Contact: Maxime Leroux
Address: 1650 Queensview Drive Suite 100
K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: Maxime.Leroux@exp.com
2. Email:

Project Information:

Project: OTT-263154
Site Location: 37 Wildpine
Sampled By: EXP
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table _____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table _____ *Indicate One*
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐ Sanitary ☐ Storm
_____ *Region*
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
_____ *Indicate One*

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 21769641 2
Cooler Quantity: 1
Arrival Temperatures: 20.5 | 20.5 | 20.4
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y / N	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	pH	Sulphate	Chloride	Electro Resistivity				Potentially Hazardous or High Concentration (Y/N)
BH4 SS4 7.5'-9.5'	Dec 11/20	AM/PM	1															✓	✓	✓	✓				
BH7 SS5 10'-12'	Dec 11/20	AM/PM	1															✓	✓	✓	✓				
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							
		AM/PM																							

Samples Relinquished By (Print Name and Sign): Ryan DiGiuseppe	Date: Jan 5/21	Time: 5:00pm	Samples Received By (Print Name and Sign):	Date: 5 Jan 21	Time: 1700
Samples Relinquished By (Print Name and Sign):	Date: 2021-01-06	Time: 16h00	Samples Received By (Print Name and Sign):	Date: 8:50	Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

Page 1 of 1
N°: T 111707

Appendix B:
Toe Erosion Photographs

Gully erosion at the Poole Creek west of cross-section A

Toe erosion at the Poole Creek west of cross-section A

Toe erosion at the Poole Creek west of cross-section A

Toe erosion at the Poole Creek west of cross-section A

Toe erosion at the Poole Creek between cross-sections A and B

Toe erosion at the Poole Creek between cross-sections A and B

Toe erosion at the Poole Creek between cross-sections A and B

Toe erosion at the Poole Creek between cross-sections A and B

The Poole Creek tributary borders and slope west of cross-section B

The Poole Creek tributary borders and slope near cross-section B

The Poole Creek tributary borders and slope between cross-sections B and C

The Poole Creek tributary borders and slope near cross-sections D

Appendix C:
Legal Notification

Legal Notification

This report was prepared by EXP Services Inc. (EXP) for the account of Latitude Homes Inc.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Report Distribution

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Carmine Zayoun, Latitude Homes Inc.; carmine@zayoungroup.com